

数据挖掘互评作业二: 频繁模式与关联规则挖掘

Readme:

代码为《数据挖掘》课程第二次互评作业 采用数据集: Kaggle——Wine Reviews

数据来源: <https://www.kaggle.com/zynicide/wine-reviews>

github代码:

1.引包

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import orangecontrib.associate.fpgrowth as oaf
import functools
```

2.加载数据集

Wine Reviews数据包含两组数据:

- 1、分别删除数据中多余的列
- 2、将两组数据合并得到data
- 3、删除data中含有缺失值的数据

```
path_1 = '../data/WineReviews/winemag-data_first150k.csv'
path_2 = '../data/WineReviews/winemag-data-130k-v2.csv'
data1 = pd.read_csv(path_1)
data2 = pd.read_csv(path_2)
data1.drop(['country', 'description', 'designation'], axis=1,
inplace=True)
data1.drop(data1.columns[0], axis=1, inplace=True)
data1.info()
data2.drop(['country', 'description', 'designation', 'taster_name',
'taster_twitter_handle', 'title'], axis=1, inplace=True)
data2.drop(data2.columns[0], axis=1, inplace=True)
data2.info()
# 将数据集合并并删除缺失值
data = pd.concat([data1, data2], ignore_index=True)
data.info()
print(data.isnull().sum())
new_data = data.dropna(axis=0)
# 在预处理数据后得到的data中, 由于country属性中均为 'US', 故之后又把country属性删去
# 重置索引
N = len(new_data)
new_data.index = range(N)
new_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150930 entries, 0 to 150929
Data columns (total 7 columns):
points      150930 non-null int64
price       137235 non-null float64
province    150925 non-null object
region_1    125870 non-null object
region_2    60953 non-null object
variety     150930 non-null object
winery      150930 non-null object
dtypes: float64(1), int64(1), object(5)
memory usage: 8.1+ MB

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 129971 entries, 0 to 129970
Data columns (total 7 columns):
points      129971 non-null int64
price       120975 non-null float64
province    129908 non-null object
region_1    108724 non-null object
region_2    50511 non-null object
variety     129970 non-null object
winery      129971 non-null object
dtypes: float64(1), int64(1), object(5)
memory usage: 6.9+ MB

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 280901 entries, 0 to 280900
Data columns (total 7 columns):
points      280901 non-null int64
price       258210 non-null float64
province    280833 non-null object
region_1    234594 non-null object
region_2    111464 non-null object
variety     280900 non-null object
winery      280901 non-null object
dtypes: float64(1), int64(1), object(5)
memory usage: 15.0+ MB
points      0
price       22691
province    68
region_1    46307
region_2    169437
variety     1
winery      0
dtype: int64

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 110996 entries, 0 to 110995
Data columns (total 7 columns):
points      110996 non-null int64
price       110996 non-null float64
province    110996 non-null object
```

```

region_1    110996 non-null object
region_2    110996 non-null object
variety     110996 non-null object
winery      110996 non-null object
dtypes: float64(1), int64(1), object(5)
memory usage: 5.9+ MB

```

3.关联规则挖掘

```

listToAnalysis = []
listToStore = []
# country  designation  points  price  province  region_1  region_2
variety  winery
for i in range(new_data.iloc[:, 0].size):
    temp = new_data.iloc[i]['points']
    listToStore.append(temp)
    temp = new_data.iloc[i]['price']
    if temp <= 50:
        temp = 'price_0_50'
    elif 50 < temp <= 100:
        temp = 'price_50_100'
    elif 100 < temp <= 200:
        temp = 'price_100_200'
    elif temp > 200:
        temp = 'price_200'
    listToStore.append(temp)
    temp = new_data.iloc[i]['province']
    listToStore.append(temp)
    temp = new_data.iloc[i]['region_2']
    listToStore.append(temp)
    temp = new_data.iloc[i]['variety']
    listToStore.append(temp)
    temp = new_data.iloc[i]['winery']
    listToStore.append(temp)
    listToAnalysis.append(listToStore.copy())
    listToStore.clear()
strSet = set(functools.reduce(lambda a, b: a + b, listToAnalysis))
strEncode = dict(zip(strSet, range(len(strSet))))
strDecode = dict(zip(strEncode.values(), strEncode.keys()))
listToAnalysis_int = [list(map(lambda item: strEncode[item], row)) for row
in listToAnalysis]

```

频繁项集itemsets为：

```

#支持度为
result = oaf.frequent_itemsets(listToAnalysis_int , .02)
itemsets = dict(result)
# 输出结果：[频繁项, 支持度]

```

```

items = []
for i in itemsets:
    temStr = ''
    for j in i:
        temStr = temStr+str(strDecode[j])+ ' & '
    temStr = temStr[:-3]
    items.append([temStr, round(itemsets[i]/N, 4)])
    temStr = temStr + ': ' + str(round(itemsets[i]/N, 4))
    # print(temStr)
# print(items)
pd.set_option('display.max_rows',500)
df = pd.DataFrame(items, columns=['频繁项集', '支持度'])
df = df.sort_values('支持度',ascending=False)
df.index = range(len(df))
print(df)

```

| | 频繁项集 | 支持度 |
|----|---|--------|
| 0 | price_0_50 | 0.8454 |
| 1 | California | 0.7036 |
| 2 | price_0_50 & California | 0.5778 |
| 3 | Central Coast | 0.2159 |
| 4 | Central Coast & California | 0.2159 |
| 5 | price_0_50 & Central Coast | 0.1907 |
| 6 | price_0_50 & Central Coast & California | 0.1907 |
| 7 | Sonoma | 0.1822 |
| 8 | Sonoma & California | 0.1822 |
| 9 | Pinot Noir | 0.1728 |
| 10 | Washington | 0.1646 |
| 11 | Washington & Columbia Valley | 0.1545 |
| 12 | Columbia Valley | 0.1545 |
| 13 | price_0_50 & Sonoma | 0.1497 |
| 14 | price_0_50 & Sonoma & California | 0.1497 |
| 15 | Washington & price_0_50 | 0.1493 |
| 16 | Cabernet Sauvignon | 0.1444 |
| 17 | Napa & California | 0.1404 |
| 18 | Napa | 0.1404 |
| 19 | price_0_50 & Columbia Valley | 0.1398 |
| 20 | price_0_50 & Columbia Valley & Washington | 0.1398 |
| 21 | price_50_100 | 0.1369 |
| 22 | Chardonnay | 0.1292 |
| 23 | 87 | 0.1268 |
| 24 | price_0_50 & Pinot Noir | 0.1262 |
| 25 | California & Pinot Noir | 0.1249 |
| 26 | price_0_50 & Chardonnay | 0.1204 |
| 27 | price_0_50 & 87 | 0.1183 |
| 28 | 88 | 0.1161 |
| 29 | Cabernet Sauvignon & California | 0.1156 |
| 30 | 90 | 0.1135 |
| 31 | California & price_50_100 | 0.1096 |
| 32 | price_0_50 & 88 | 0.1056 |

| | | |
|----|--|--------|
| 33 | California & Chardonnay | 0.1031 |
| 34 | price_0_50 & 90 | 0.0953 |
| 35 | price_0_50 & California & Chardonnay | 0.0952 |
| 36 | 86 | 0.0916 |
| 37 | price_0_50 & Cabernet Sauvignon | 0.0902 |
| 38 | price_0_50 & California & Pinot Noir | 0.0890 |
| 39 | 87 & California | 0.0876 |
| 40 | price_0_50 & 86 | 0.0865 |
| 41 | Oregon | 0.0859 |
| 42 | 91 | 0.0821 |
| 43 | price_0_50 & Napa & California | 0.0820 |
| 44 | price_0_50 & Napa | 0.0820 |
| 45 | price_0_50 & 87 & California | 0.0801 |
| 46 | 92 | 0.0773 |
| 47 | California & 90 | 0.0765 |
| 48 | 85 | 0.0747 |
| 49 | 89 | 0.0747 |
| 50 | price_0_50 & Oregon | 0.0731 |
| 51 | price_0_50 & 85 | 0.0717 |
| 52 | 88 & California | 0.0702 |
| 53 | price_0_50 & 89 | 0.0667 |
| 54 | price_0_50 & Cabernet Sauvignon & California | 0.0664 |
| 55 | Syrah | 0.0661 |
| 56 | 86 & California | 0.0658 |
| 57 | 84 | 0.0653 |
| 58 | Napa & Cabernet Sauvignon | 0.0650 |
| 59 | Napa & Cabernet Sauvignon & California | 0.0650 |
| 60 | price_0_50 & 91 | 0.0645 |
| 61 | 84 & price_0_50 | 0.0628 |
| 62 | price_0_50 & California & 90 | 0.0616 |
| 63 | price_0_50 & 86 & California | 0.0611 |
| 64 | price_0_50 & 88 & California | 0.0609 |
| 65 | Willamette Valley | 0.0593 |
| 66 | Willamette Valley & Oregon | 0.0593 |
| 67 | price_0_50 & Syrah | 0.0580 |
| 68 | Zinfandel | 0.0571 |
| 69 | 92 & California | 0.0567 |
| 70 | California & Zinfandel | 0.0556 |
| 71 | California Other | 0.0556 |
| 72 | California & California Other | 0.0556 |
| 73 | price_0_50 & Zinfandel | 0.0552 |
| 74 | 84 & California | 0.0551 |
| 75 | 85 & California | 0.0547 |
| 76 | price_0_50 & California Other | 0.0544 |
| 77 | price_0_50 & California & California Other | 0.0544 |
| 78 | price_0_50 & California & Zinfandel | 0.0538 |
| 79 | 92 & price_0_50 | 0.0533 |
| 80 | Red Blend | 0.0531 |
| 81 | 84 & California & price_0_50 | 0.0527 |
| 82 | price_0_50 & 85 & California | 0.0519 |
| 83 | California & 91 | 0.0517 |

| | | |
|-----|---|--------|
| 84 | Merlot | 0.0515 |
| 85 | Central Coast & Pinot Noir | 0.0512 |
| 86 | Central Coast & California & Pinot Noir | 0.0512 |
| 87 | Sonoma & Pinot Noir | 0.0509 |
| 88 | Sonoma & Pinot Noir & California | 0.0509 |
| 89 | 93 | 0.0505 |
| 90 | Willamette Valley & Oregon & price_0_50 | 0.0482 |
| 91 | Willamette Valley & price_0_50 | 0.0482 |
| 92 | price_0_50 & Merlot | 0.0480 |
| 93 | Red Blend & price_0_50 | 0.0464 |
| 94 | New York | 0.0459 |
| 95 | Pinot Noir & price_50_100 | 0.0458 |
| 96 | price_0_50 & New York | 0.0452 |
| 97 | Oregon & Pinot Noir | 0.0450 |
| 98 | Napa & California & price_50_100 | 0.0447 |
| 99 | Napa & price_50_100 | 0.0447 |
| 100 | Cabernet Sauvignon & price_50_100 | 0.0430 |
| 101 | California & 89 | 0.0428 |
| 102 | Syrah & California | 0.0405 |
| 103 | Sauvignon Blanc | 0.0403 |
| 104 | price_0_50 & Sauvignon Blanc | 0.0402 |
| 105 | Willamette Valley & Pinot Noir | 0.0398 |
| 106 | Willamette Valley & Oregon & Pinot Noir | 0.0398 |
| 107 | 93 & California | 0.0387 |
| 108 | price_0_50 & California & 91 | 0.0387 |
| 109 | Cabernet Sauvignon & California & price_50_100 | 0.0384 |
| 110 | price_0_50 & Central Coast & Pinot Noir | 0.0378 |
| 111 | price_0_50 & Central Coast & California & Pino... | 0.0378 |
| 112 | 92 & California & price_0_50 | 0.0377 |
| 113 | price_0_50 & California & 89 | 0.0371 |
| 114 | price_0_50 & Syrah & California | 0.0363 |
| 115 | Central Coast & California & Chardonnay | 0.0358 |
| 116 | Central Coast & Chardonnay | 0.0358 |
| 117 | California & Pinot Noir & price_50_100 | 0.0354 |
| 118 | 83 | 0.0348 |
| 119 | price_0_50 & Central Coast & Chardonnay | 0.0345 |
| 120 | price_0_50 & Central Coast & California & Char... | 0.0345 |
| 121 | price_0_50 & Oregon & Pinot Noir | 0.0343 |
| 122 | California & Sauvignon Blanc | 0.0343 |
| 123 | price_0_50 & California & Sauvignon Blanc | 0.0342 |
| 124 | price_0_50 & 83 | 0.0340 |
| 125 | California & Sonoma & Chardonnay | 0.0337 |
| 126 | Sonoma & Chardonnay | 0.0337 |
| 127 | price_0_50 & Sonoma & Pinot Noir & California | 0.0328 |
| 128 | price_0_50 & Sonoma & Pinot Noir | 0.0328 |
| 129 | Merlot & California | 0.0327 |
| 130 | Sonoma & California & price_50_100 | 0.0312 |
| 131 | Sonoma & price_50_100 | 0.0312 |
| 132 | Red Blend & California | 0.0311 |
| 133 | Napa & Cabernet Sauvignon & price_50_100 | 0.0311 |
| 134 | Napa & Cabernet Sauvignon & California & price... | 0.0311 |

| | | |
|-----|---|--------|
| 135 | Bordeaux-style Red Blend | 0.0311 |
| 136 | 94 | 0.0305 |
| 137 | price_0_50 & Merlot & California | 0.0301 |
| 138 | price_0_50 & California & Sonoma & Chardonnay | 0.0297 |
| 139 | price_0_50 & Sonoma & Chardonnay | 0.0297 |
| 140 | Willamette Valley & Oregon & Pinot Noir & pric... | 0.0296 |
| 141 | Willamette Valley & Pinot Noir & price_0_50 | 0.0296 |
| 142 | Finger Lakes | 0.0295 |
| 143 | Finger Lakes & New York | 0.0295 |
| 144 | Finger Lakes & price_0_50 | 0.0292 |
| 145 | Finger Lakes & New York & price_0_50 | 0.0292 |
| 146 | Riesling | 0.0285 |
| 147 | price_0_50 & 93 | 0.0285 |
| 148 | 82 | 0.0284 |
| 149 | price_0_50 & Riesling | 0.0282 |
| 150 | Sierra Foothills | 0.0281 |
| 151 | Sierra Foothills & California | 0.0281 |
| 152 | California & 83 | 0.0281 |
| 153 | price_0_50 & 82 | 0.0278 |
| 154 | price_0_50 & Sierra Foothills & California | 0.0276 |
| 155 | price_0_50 & Sierra Foothills | 0.0276 |
| 156 | price_0_50 & California & 83 | 0.0273 |
| 157 | Washington & 88 | 0.0268 |
| 158 | Red Blend & California & price_0_50 | 0.0265 |
| 159 | 87 & Central Coast | 0.0263 |
| 160 | 87 & California & Central Coast | 0.0263 |
| 161 | price_0_50 & Washington & 88 | 0.0261 |
| 162 | Washington & Cabernet Sauvignon | 0.0255 |
| 163 | California & Napa-Sonoma | 0.0253 |
| 164 | Napa-Sonoma | 0.0253 |
| 165 | price_0_50 & 87 & Central Coast | 0.0250 |
| 166 | Washington & Columbia Valley & 88 | 0.0250 |
| 167 | price_0_50 & 87 & California & Central Coast | 0.0250 |
| 168 | Columbia Valley & 88 | 0.0250 |
| 169 | California & 82 | 0.0246 |
| 170 | Central Coast & price_50_100 | 0.0245 |
| 171 | Central Coast & California & price_50_100 | 0.0245 |
| 172 | price_0_50 & Columbia Valley & 88 | 0.0244 |
| 173 | price_0_50 & Columbia Valley & Washington & 88 | 0.0244 |
| 174 | 87 & Sonoma & California | 0.0243 |
| 175 | 87 & Sonoma | 0.0243 |
| 176 | Sonoma & Zinfandel | 0.0242 |
| 177 | California & Sonoma & Zinfandel | 0.0242 |
| 178 | Cabernet Sauvignon & Columbia Valley | 0.0241 |
| 179 | Washington & Cabernet Sauvignon & Columbia Valley | 0.0241 |
| 180 | price_0_50 & California & 82 | 0.0240 |
| 181 | 94 & California | 0.0237 |
| 182 | price_0_50 & Napa & Cabernet Sauvignon & Calif... | 0.0237 |
| 183 | price_0_50 & Napa & Cabernet Sauvignon | 0.0237 |
| 184 | Sonoma & 90 | 0.0232 |
| 185 | California & Sonoma & 90 | 0.0232 |

| | | |
|-----|--|--------|
| 186 | price_0_50 & Sonoma & Zinfandel | 0.0230 |
| 187 | price_0_50 & California & Sonoma & Zinfandel | 0.0230 |
| 188 | price_0_50 & 87 & Sonoma & California | 0.0225 |
| 189 | Washington & Syrah | 0.0225 |
| 190 | price_0_50 & 87 & Sonoma | 0.0225 |
| 191 | Washington & 90 | 0.0222 |
| 192 | Central Coast & 88 | 0.0220 |
| 193 | Central Coast & 88 & California | 0.0220 |
| 194 | 92 & price_50_100 | 0.0218 |
| 195 | Syrah & Columbia Valley | 0.0217 |
| 196 | Washington & Syrah & Columbia Valley | 0.0217 |
| 197 | Mendocino/Lake Counties | 0.0215 |
| 198 | California & Mendocino/Lake Counties | 0.0215 |
| 199 | price_0_50 & 93 & California | 0.0211 |
| 200 | Central Coast & California & 90 | 0.0211 |
| 201 | Central Coast & 90 | 0.0211 |
| 202 | price_0_50 & California & Napa-Sonoma | 0.0210 |
| 203 | price_0_50 & Napa-Sonoma | 0.0210 |
| 204 | price_0_50 & Cabernet Sauvignon & Washington | 0.0208 |
| 205 | Columbia Valley & 90 | 0.0208 |
| 206 | Washington & Columbia Valley & 90 | 0.0208 |
| 207 | price_0_50 & Washington & 90 | 0.0206 |
| 208 | Cabernet Sauvignon & Sonoma & California | 0.0204 |
| 209 | Cabernet Sauvignon & Sonoma | 0.0204 |
| 210 | Pinot Noir & 90 | 0.0204 |
| 211 | price_0_50 & Central Coast & 88 & California | 0.0202 |
| 212 | price_0_50 & Central Coast & 88 | 0.0202 |
| 213 | Washington & 91 | 0.0202 |
| 214 | 92 & Central Coast & California | 0.0201 |
| 215 | 92 & Central Coast | 0.0201 |

关联规则及其支持度和置信度

```

rules = oaf.association_rules(itemsets, .5) #置信度
rules = list(rules)
# Rules(规则前项, 规则后项, 支持度, 置信度)
returnRules = []
for i in rules:
    temStr = '';
    for j in i[0]: #处理第一个frozenset
        temStr = temStr+str(strDecode[j])+' & '
    temStr = temStr[:-3]
    temStr = temStr + ' ==> '
    for j in i[1]:
        temStr = temStr+str(strDecode[j])+' & '
    temStr = temStr[:-3]
    returnRules.append([temStr, round(i[2]/N, 4), round(i[3], 4)])
    temStr = temStr + ';' + '\t'+str(i[2]) + ';' + '\t'+str(i[3])
df = pd.DataFrame(returnRules, columns=['关联规则', '支持度', '置信度'])
df = df.sort_values('置信度', ascending=False)

```



```
df.index = range(len(df))
print(df)
```

| 度 | | 关联规则 | 支持度 | 置信 |
|----|---|------------|--------|--------|
| 0 | Mendocino/Lake Counties ==> | California | 0.0215 | 1.0000 |
| 1 | price_0_50 & Columbia Valley & 88 ==> | Washington | 0.0244 | 1.0000 |
| 2 | Willamette Valley & price_0_50 ==> | Oregon | 0.0482 | 1.0000 |
| 3 | Syrah & Columbia Valley ==> | Washington | 0.0217 | 1.0000 |
| 4 | Napa-Sonoma ==> | California | 0.0253 | 1.0000 |
| 5 | Sierra Foothills ==> | California | 0.0281 | 1.0000 |
| 6 | 92 & Central Coast ==> | California | 0.0201 | 1.0000 |
| 7 | Columbia Valley & 90 ==> | Washington | 0.0208 | 1.0000 |
| 8 | Central Coast & 90 ==> | California | 0.0211 | 1.0000 |
| 9 | price_0_50 & Sonoma & Zinfandel ==> | California | 0.0230 | 1.0000 |
| 10 | Sonoma & 90 ==> | California | 0.0232 | 1.0000 |
| 11 | Columbia Valley & 88 ==> | Washington | 0.0250 | 1.0000 |
| 12 | price_0_50 & Central Coast ==> | California | 0.1907 | 1.0000 |
| 13 | Central Coast & 88 ==> | California | 0.0220 | 1.0000 |
| 14 | price_0_50 & Sonoma ==> | California | 0.1497 | 1.0000 |
| 15 | Sonoma & Pinot Noir ==> | California | 0.0509 | 1.0000 |
| 16 | 87 & Central Coast ==> | California | 0.0263 | 1.0000 |
| 17 | 87 & Sonoma ==> | California | 0.0243 | 1.0000 |
| 18 | Central Coast & Chardonnay ==> | California | 0.0358 | 1.0000 |
| 19 | Central Coast & Pinot Noir ==> | California | 0.0512 | 1.0000 |
| 20 | Sonoma & Chardonnay ==> | California | 0.0337 | 1.0000 |
| 21 | Napa & price_50_100 ==> | California | 0.0447 | 1.0000 |
| 22 | Central Coast & price_50_100 ==> | California | 0.0245 | 1.0000 |
| 23 | Sonoma & price_50_100 ==> | California | 0.0312 | 1.0000 |
| 24 | price_0_50 & Columbia Valley ==> | Washington | 0.1398 | 1.0000 |
| 25 | Napa & Cabernet Sauvignon ==> | California | 0.0650 | 1.0000 |
| 26 | Cabernet Sauvignon & Sonoma ==> | California | 0.0204 | 1.0000 |
| 27 | price_0_50 & Napa ==> | California | 0.0820 | 1.0000 |
| 28 | Finger Lakes ==> | New York | 0.0295 | 1.0000 |
| 29 | California Other ==> | California | 0.0556 | 1.0000 |
| 30 | Willamette Valley & Pinot Noir & price_0_50 ==... | | 0.0296 | 1.0000 |
| 31 | Willamette Valley & Pinot Noir ==> | Oregon | 0.0398 | 1.0000 |
| 32 | Finger Lakes & price_0_50 ==> | New York | 0.0292 | 1.0000 |
| 33 | price_0_50 & Sonoma & Pinot Noir ==> | California | 0.0328 | 1.0000 |
| 34 | Napa ==> | California | 0.1404 | 1.0000 |
| 35 | Columbia Valley ==> | Washington | 0.1545 | 1.0000 |
| 36 | price_0_50 & Central Coast & Pinot Noir ==> | Ca... | 0.0378 | 1.0000 |
| 37 | price_0_50 & Napa & Cabernet Sauvignon ==> | Cal... | 0.0237 | 1.0000 |
| 38 | Sonoma ==> | California | 0.1822 | 1.0000 |
| 39 | Central Coast ==> | California | 0.2159 | 1.0000 |
| 40 | price_0_50 & Napa-Sonoma ==> | California | 0.0210 | 1.0000 |
| 41 | price_0_50 & Sierra Foothills ==> | California | 0.0276 | 1.0000 |
| 42 | Napa & Cabernet Sauvignon & price_50_100 ==> | C... | 0.0311 | 1.0000 |
| 43 | price_0_50 & Sonoma & Chardonnay ==> | California | 0.0297 | 1.0000 |

| | | | |
|----|---|--------|--------|
| 44 | price_0_50 & Central Coast & Chardonnay ==> Ca... | 0.0345 | 1.0000 |
| 45 | Cabernet Sauvignon & Columbia Valley ==> Washi... | 0.0241 | 1.0000 |
| 46 | price_0_50 & 87 & Central Coast ==> California | 0.0250 | 1.0000 |
| 47 | Willamette Valley ==> Oregon | 0.0593 | 1.0000 |
| 48 | Sonoma & Zinfandel ==> California | 0.0242 | 1.0000 |
| 49 | price_0_50 & Central Coast & 88 ==> California | 0.0202 | 1.0000 |
| 50 | price_0_50 & California Other ==> California | 0.0544 | 1.0000 |
| 51 | price_0_50 & 87 & Sonoma ==> California | 0.0225 | 1.0000 |
| 52 | Sauvignon Blanc ==> price_0_50 | 0.0402 | 0.9975 |
| 53 | California & Sauvignon Blanc ==> price_0_50 | 0.0342 | 0.9971 |
| 54 | Finger Lakes ==> price_0_50 | 0.0292 | 0.9914 |
| 55 | Finger Lakes & New York ==> price_0_50 | 0.0292 | 0.9914 |
| 56 | Finger Lakes ==> price_0_50 & New York | 0.0292 | 0.9914 |
| 57 | Riesling ==> price_0_50 | 0.0282 | 0.9911 |
| 58 | New York ==> price_0_50 | 0.0452 | 0.9853 |
| 59 | Sierra Foothills ==> price_0_50 & California | 0.0276 | 0.9824 |
| 60 | Sierra Foothills & California ==> price_0_50 | 0.0276 | 0.9824 |
| 61 | Sierra Foothills ==> price_0_50 | 0.0276 | 0.9824 |
| 62 | 82 ==> price_0_50 | 0.0278 | 0.9791 |
| 63 | California Other ==> price_0_50 & California | 0.0544 | 0.9783 |
| 64 | California & California Other ==> price_0_50 | 0.0544 | 0.9783 |
| 65 | California Other ==> price_0_50 | 0.0544 | 0.9783 |
| 66 | California & 82 ==> price_0_50 | 0.0240 | 0.9773 |
| 67 | Washington & 88 ==> price_0_50 | 0.0261 | 0.9761 |
| 68 | 83 ==> price_0_50 | 0.0340 | 0.9759 |
| 69 | Columbia Valley & 88 ==> Washington & price_0_50 | 0.0244 | 0.9751 |
| 70 | Columbia Valley & 88 ==> price_0_50 | 0.0244 | 0.9751 |
| 71 | Washington & Columbia Valley & 88 ==> price_0_50 | 0.0244 | 0.9751 |
| 72 | Zinfandel ==> California | 0.0556 | 0.9741 |
| 73 | price_0_50 & Zinfandel ==> California | 0.0538 | 0.9736 |
| 74 | California & 83 ==> price_0_50 | 0.0273 | 0.9714 |
| 75 | Zinfandel ==> price_0_50 | 0.0552 | 0.9678 |
| 76 | California & Zinfandel ==> price_0_50 | 0.0538 | 0.9673 |
| 77 | Central Coast & Chardonnay ==> price_0_50 | 0.0345 | 0.9633 |
| 78 | Central Coast & California & Chardonnay ==> pr... | 0.0345 | 0.9633 |
| 79 | Central Coast & Chardonnay ==> price_0_50 & Ca... | 0.0345 | 0.9633 |
| 80 | Washington & Syrah ==> Columbia Valley | 0.0217 | 0.9616 |
| 81 | 84 ==> price_0_50 | 0.0628 | 0.9614 |
| 82 | 85 ==> price_0_50 | 0.0717 | 0.9605 |
| 83 | 84 & California ==> price_0_50 | 0.0527 | 0.9564 |
| 84 | Sonoma & Zinfandel ==> price_0_50 & California | 0.0230 | 0.9534 |
| 85 | Sonoma & Zinfandel ==> price_0_50 | 0.0230 | 0.9534 |
| 86 | Sonoma & California & Zinfandel ==> price_0_50 | 0.0230 | 0.9534 |
| 87 | 85 & California ==> price_0_50 | 0.0519 | 0.9491 |
| 88 | 87 & Central Coast ==> price_0_50 | 0.0250 | 0.9486 |
| 89 | 87 & California & Central Coast ==> price_0_50 | 0.0250 | 0.9486 |
| 90 | 87 & Central Coast ==> price_0_50 & California | 0.0250 | 0.9486 |
| 91 | Washington & Cabernet Sauvignon ==> Columbia V... | 0.0241 | 0.9463 |
| 92 | 86 ==> price_0_50 | 0.0865 | 0.9442 |
| 93 | Zinfandel ==> price_0_50 & California | 0.0538 | 0.9422 |
| 94 | Washington ==> Columbia Valley | 0.1545 | 0.9390 |

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|-----|---|--------|--------|
| 95 | price_0_50 & Washington ==> Columbia Valley | 0.1398 | 0.9362 |
| 96 | Washington & 90 ==> Columbia Valley | 0.0208 | 0.9359 |
| 97 | Washington & 88 ==> Columbia Valley | 0.0250 | 0.9330 |
| 98 | 87 ==> price_0_50 | 0.1183 | 0.9330 |
| 99 | Merlot ==> price_0_50 | 0.0480 | 0.9322 |
| 100 | price_0_50 & Washington & 88 ==> Columbia Valley | 0.0244 | 0.9321 |
| 101 | Chardonnay ==> price_0_50 | 0.1204 | 0.9319 |
| 102 | 86 & California ==> price_0_50 | 0.0611 | 0.9278 |
| 103 | Washington & 90 ==> price_0_50 | 0.0206 | 0.9274 |
| 104 | 87 & Sonoma ==> price_0_50 | 0.0225 | 0.9257 |
| 105 | 87 & Sonoma & California ==> price_0_50 | 0.0225 | 0.9257 |
| 106 | 87 & Sonoma ==> price_0_50 & California | 0.0225 | 0.9257 |
| 107 | California & Chardonnay ==> price_0_50 | 0.0952 | 0.9237 |
| 108 | Merlot & California ==> price_0_50 | 0.0301 | 0.9193 |
| 109 | Central Coast & 88 ==> price_0_50 | 0.0202 | 0.9170 |
| 110 | Central Coast & 88 ==> price_0_50 & California | 0.0202 | 0.9170 |
| 111 | Central Coast & 88 & California ==> price_0_50 | 0.0202 | 0.9170 |
| 112 | 87 & California ==> price_0_50 | 0.0801 | 0.9138 |
| 113 | Washington & 88 ==> price_0_50 & Columbia Valley | 0.0244 | 0.9098 |
| 114 | 88 ==> price_0_50 | 0.1056 | 0.9097 |
| 115 | Washington ==> price_0_50 | 0.1493 | 0.9076 |
| 116 | Columbia Valley ==> price_0_50 | 0.1398 | 0.9049 |
| 117 | Washington & Columbia Valley ==> price_0_50 | 0.1398 | 0.9049 |
| 118 | Columbia Valley ==> Washington & price_0_50 | 0.1398 | 0.9049 |
| 119 | Syrah & California ==> price_0_50 | 0.0363 | 0.8956 |
| 120 | Cabernet Sauvignon & price_50_100 ==> California | 0.0384 | 0.8936 |
| 121 | 89 ==> price_0_50 | 0.0667 | 0.8931 |
| 122 | Oregon & Pinot Noir ==> Willamette Valley | 0.0398 | 0.8851 |
| 123 | Central Coast ==> price_0_50 & California | 0.1907 | 0.8835 |
| 124 | Central Coast & California ==> price_0_50 | 0.1907 | 0.8835 |
| 125 | Central Coast ==> price_0_50 | 0.1907 | 0.8835 |
| 126 | Sonoma & Chardonnay ==> price_0_50 & California | 0.0297 | 0.8822 |
| 127 | Sonoma & California & Chardonnay ==> price_0_50 | 0.0297 | 0.8822 |
| 128 | Sonoma & Chardonnay ==> price_0_50 | 0.0297 | 0.8822 |
| 129 | Syrah ==> price_0_50 | 0.0580 | 0.8771 |
| 130 | Red Blend ==> price_0_50 | 0.0464 | 0.8739 |
| 131 | 88 & California ==> price_0_50 | 0.0609 | 0.8682 |
| 132 | 82 ==> California | 0.0246 | 0.8659 |
| 133 | California & 89 ==> price_0_50 | 0.0371 | 0.8648 |
| 134 | price_0_50 & 82 ==> California | 0.0240 | 0.8643 |
| 135 | price_0_50 & Oregon & Pinot Noir ==> Willamett... | 0.0296 | 0.8636 |
| 136 | Red Blend & California ==> price_0_50 | 0.0265 | 0.8519 |
| 137 | Oregon ==> price_0_50 | 0.0731 | 0.8509 |
| 138 | Sauvignon Blanc ==> California | 0.0343 | 0.8506 |
| 139 | price_0_50 & Sauvignon Blanc ==> California | 0.0342 | 0.8502 |
| 140 | Washington ==> price_0_50 & Columbia Valley | 0.1398 | 0.8497 |
| 141 | Sauvignon Blanc ==> price_0_50 & California | 0.0342 | 0.8481 |
| 142 | 82 ==> price_0_50 & California | 0.0240 | 0.8462 |
| 143 | 84 ==> California | 0.0551 | 0.8443 |
| 144 | 84 & price_0_50 ==> California | 0.0527 | 0.8399 |
| 145 | 90 ==> price_0_50 | 0.0953 | 0.8398 |

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|-----|---|--------|--------|
| 146 | Napa-Sonoma ==> price_0_50 & California | 0.0210 | 0.8307 |
| 147 | Napa-Sonoma ==> price_0_50 | 0.0210 | 0.8307 |
| 148 | California & Napa-Sonoma ==> price_0_50 | 0.0210 | 0.8307 |
| 149 | Sonoma ==> price_0_50 & California | 0.1497 | 0.8216 |
| 150 | Sonoma & California ==> price_0_50 | 0.1497 | 0.8216 |
| 151 | Sonoma ==> price_0_50 | 0.1497 | 0.8216 |
| 152 | California ==> price_0_50 | 0.5778 | 0.8211 |
| 153 | Washington & Cabernet Sauvignon ==> price_0_50 | 0.0208 | 0.8162 |
| 154 | Willamette Valley & Oregon ==> price_0_50 | 0.0482 | 0.8122 |
| 155 | Willamette Valley ==> price_0_50 & Oregon | 0.0482 | 0.8122 |
| 156 | Willamette Valley ==> price_0_50 | 0.0482 | 0.8122 |
| 157 | Cabernet Sauvignon & California & price_50_100... | 0.0311 | 0.8101 |
| 158 | 84 ==> price_0_50 & California | 0.0527 | 0.8074 |
| 159 | 83 ==> California | 0.0281 | 0.8063 |
| 160 | California & 90 ==> price_0_50 | 0.0616 | 0.8059 |
| 161 | price_0_50 & 83 ==> California | 0.0273 | 0.8025 |
| 162 | Cabernet Sauvignon ==> California | 0.1156 | 0.8007 |
| 163 | price_50_100 ==> California | 0.1096 | 0.8007 |
| 164 | Chardonnay ==> California | 0.1031 | 0.7977 |
| 165 | price_0_50 & Chardonnay ==> California | 0.0952 | 0.7907 |
| 166 | 91 ==> price_0_50 | 0.0645 | 0.7859 |
| 167 | 83 ==> price_0_50 & California | 0.0273 | 0.7832 |
| 168 | 94 ==> California | 0.0237 | 0.7769 |
| 169 | Pinot Noir & price_50_100 ==> California | 0.0354 | 0.7730 |
| 170 | 93 ==> California | 0.0387 | 0.7663 |
| 171 | Oregon & Pinot Noir ==> price_0_50 | 0.0343 | 0.7628 |
| 172 | California & 91 ==> price_0_50 | 0.0387 | 0.7469 |
| 173 | Willamette Valley & Pinot Noir ==> price_0_50 ... | 0.0296 | 0.7442 |
| 174 | Willamette Valley & Pinot Noir ==> price_0_50 | 0.0296 | 0.7442 |
| 175 | Willamette Valley & Oregon & Pinot Noir ==> pr... | 0.0296 | 0.7442 |
| 176 | price_0_50 & 93 ==> California | 0.0211 | 0.7382 |
| 177 | Central Coast & Pinot Noir ==> price_0_50 | 0.0378 | 0.7381 |
| 178 | Central Coast & California & Pinot Noir ==> pr... | 0.0378 | 0.7381 |
| 179 | Central Coast & Pinot Noir ==> price_0_50 & Ca... | 0.0378 | 0.7381 |
| 180 | Chardonnay ==> price_0_50 & California | 0.0952 | 0.7368 |
| 181 | price_0_50 & Cabernet Sauvignon ==> California | 0.0664 | 0.7358 |
| 182 | 92 ==> California | 0.0567 | 0.7331 |
| 183 | 85 ==> California | 0.0547 | 0.7330 |
| 184 | Pinot Noir ==> price_0_50 | 0.1262 | 0.7302 |
| 185 | price_0_50 & 85 ==> California | 0.0519 | 0.7242 |
| 186 | Cabernet Sauvignon & price_50_100 ==> Napa & C... | 0.0311 | 0.7239 |
| 187 | Cabernet Sauvignon & price_50_100 ==> Napa | 0.0311 | 0.7239 |
| 188 | Pinot Noir ==> California | 0.1249 | 0.7228 |
| 189 | 86 ==> California | 0.0658 | 0.7182 |
| 190 | California & Pinot Noir ==> price_0_50 | 0.0890 | 0.7124 |
| 191 | 92 & price_0_50 ==> California | 0.0377 | 0.7065 |
| 192 | price_0_50 & 86 ==> California | 0.0611 | 0.7057 |
| 193 | price_0_50 & Pinot Noir ==> California | 0.0890 | 0.7053 |
| 194 | Napa & California & price_50_100 ==> Cabernet ... | 0.0311 | 0.6965 |
| 195 | Napa & price_50_100 ==> Cabernet Sauvignon | 0.0311 | 0.6965 |
| 196 | Napa & price_50_100 ==> Cabernet Sauvignon & C... | 0.0311 | 0.6965 |

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|-----|---|--------|--------|
| 197 | 85 ==> price_0_50 & California | 0.0519 | 0.6957 |
| 198 | 87 ==> California | 0.0876 | 0.6911 |
| 199 | Oregon ==> Willamette Valley | 0.0593 | 0.6900 |
| 200 | 92 ==> price_0_50 | 0.0533 | 0.6894 |
| 201 | price_0_50 ==> California | 0.5778 | 0.6834 |
| 202 | price_0_50 & 87 ==> California | 0.0801 | 0.6769 |
| 203 | 90 ==> California | 0.0765 | 0.6738 |
| 204 | Willamette Valley ==> Pinot Noir | 0.0398 | 0.6718 |
| 205 | Willamette Valley ==> Oregon & Pinot Noir | 0.0398 | 0.6718 |
| 206 | Willamette Valley & Oregon ==> Pinot Noir | 0.0398 | 0.6718 |
| 207 | 86 ==> price_0_50 & California | 0.0611 | 0.6664 |
| 208 | 92 & California ==> price_0_50 | 0.0377 | 0.6644 |
| 209 | Oregon & Pinot Noir ==> price_0_50 & Willamett... | 0.0296 | 0.6587 |
| 210 | price_0_50 & Oregon ==> Willamette Valley | 0.0482 | 0.6586 |
| 211 | price_0_50 & 90 ==> California | 0.0616 | 0.6467 |
| 212 | price_0_50 & New York ==> Finger Lakes | 0.0292 | 0.6465 |
| 213 | Sonoma & Pinot Noir & California ==> price_0_50 | 0.0328 | 0.6446 |
| 214 | Sonoma & Pinot Noir ==> price_0_50 & California | 0.0328 | 0.6446 |
| 215 | Sonoma & Pinot Noir ==> price_0_50 | 0.0328 | 0.6446 |
| 216 | New York ==> Finger Lakes | 0.0295 | 0.6425 |
| 217 | New York ==> Finger Lakes & price_0_50 | 0.0292 | 0.6370 |
| 218 | Merlot ==> California | 0.0327 | 0.6344 |
| 219 | 87 ==> price_0_50 & California | 0.0801 | 0.6316 |
| 220 | 91 ==> California | 0.0517 | 0.6306 |
| 221 | price_0_50 & Merlot ==> California | 0.0301 | 0.6257 |
| 222 | price_0_50 & Syrah ==> California | 0.0363 | 0.6251 |
| 223 | Cabernet Sauvignon ==> price_0_50 | 0.0902 | 0.6245 |
| 224 | Willamette Valley & Oregon & price_0_50 ==> Pi... | 0.0296 | 0.6156 |
| 225 | Willamette Valley & price_0_50 ==> Oregon & Pi... | 0.0296 | 0.6156 |
| 226 | Willamette Valley & price_0_50 ==> Pinot Noir | 0.0296 | 0.6156 |
| 227 | Syrah ==> California | 0.0405 | 0.6122 |
| 228 | 88 ==> California | 0.0702 | 0.6042 |
| 229 | price_0_50 & 91 ==> California | 0.0387 | 0.5992 |
| 230 | Red Blend ==> California | 0.0311 | 0.5856 |
| 231 | Napa & California ==> price_0_50 | 0.0820 | 0.5844 |
| 232 | Napa ==> price_0_50 & California | 0.0820 | 0.5844 |
| 233 | Napa ==> price_0_50 | 0.0820 | 0.5844 |
| 234 | Merlot ==> price_0_50 & California | 0.0301 | 0.5832 |
| 235 | price_0_50 & 88 ==> California | 0.0609 | 0.5767 |
| 236 | Cabernet Sauvignon & California ==> price_0_50 | 0.0664 | 0.5739 |
| 237 | 89 ==> California | 0.0428 | 0.5734 |
| 238 | Red Blend & price_0_50 ==> California | 0.0265 | 0.5709 |
| 239 | 93 ==> price_0_50 | 0.0285 | 0.5645 |
| 240 | Cabernet Sauvignon & California ==> Napa | 0.0650 | 0.5619 |
| 241 | Oregon ==> price_0_50 & Willamette Valley | 0.0482 | 0.5604 |
| 242 | price_0_50 & 89 ==> California | 0.0371 | 0.5552 |
| 243 | Syrah ==> price_0_50 & California | 0.0363 | 0.5483 |
| 244 | 93 & California ==> price_0_50 | 0.0211 | 0.5438 |
| 245 | 90 ==> price_0_50 & California | 0.0616 | 0.5431 |
| 246 | 88 ==> price_0_50 & California | 0.0609 | 0.5246 |
| 247 | Oregon ==> Pinot Noir | 0.0450 | 0.5237 |

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|-----|---|--------|--------|
| 248 | Pinot Noir ==> price_0_50 & California | 0.0890 | 0.5150 |
| 249 | Willamette Valley ==> price_0_50 & Pinot Noir | 0.0296 | 0.5000 |
| 250 | Willamette Valley & Oregon ==> price_0_50 & Pi... | 0.0296 | 0.5000 |
| 251 | Willamette Valley ==> price_0_50 & Oregon & Pi... | 0.0296 | 0.5000 |

关联规则评价（前项，后项，支持度，置信度，lift, leverage）

```

results = list(oaf.rules_stats(rules, itemsets, len(listToAnalysis)))
resultsRules = []
for i in results:
    temStr = ''
    for j in i[0]: #处理第一个frozenset
        temStr = temStr+str(strDecode[j])+' & '
    temStr = temStr[:-3]
    temStr = temStr + ' ==> '
    for j in i[1]:
        temStr = temStr+str(strDecode[j])+' & '
    temStr = temStr[:-3]
    resultsRules.append([temStr, round(i[2]/N, 4), round(i[3], 4),
round(i[6], 4), round(i[7], 4)])
    temStr = temStr + ';' +'\t'+str(i[2])+';' +'\t'+str(i[3])+';' +'\t'+str(i[6])+';' +'\t'+str(i[7])
df = pd.DataFrame(resultsRules, columns=['关联规则', '支持度', '置信度',
'lift', 'leverage'])
df = df.sort_values('lift',ascending=False)
df.index = range(len(df))
print(df)

```

| 度 \ | 关联规则 | 支持度 | 置信 |
|-----|---|--------|--------|
| 0 | Finger Lakes ==> price_0_50 & New York | 0.0292 | 0.9914 |
| 1 | price_0_50 & New York ==> Finger Lakes | 0.0292 | 0.6465 |
| 2 | Finger Lakes ==> New York | 0.0295 | 1.0000 |
| 3 | New York ==> Finger Lakes | 0.0295 | 0.6425 |
| 4 | Finger Lakes & price_0_50 ==> New York | 0.0292 | 1.0000 |
| 5 | New York ==> Finger Lakes & price_0_50 | 0.0292 | 0.6370 |
| 6 | Oregon & Pinot Noir ==> Willamette Valley | 0.0398 | 0.8851 |
| 7 | Willamette Valley ==> Oregon & Pinot Noir | 0.0398 | 0.6718 |
| 8 | Willamette Valley ==> price_0_50 & Oregon & Pi... | 0.0296 | 0.5000 |
| 9 | price_0_50 & Oregon & Pinot Noir ==> Willamett... | 0.0296 | 0.8636 |
| 10 | Willamette Valley & price_0_50 ==> Oregon & Pi... | 0.0296 | 0.6156 |
| 11 | Oregon & Pinot Noir ==> price_0_50 & Willamett... | 0.0296 | 0.6587 |
| 12 | Oregon ==> Willamette Valley | 0.0593 | 0.6900 |
| 13 | Willamette Valley & price_0_50 ==> Oregon | 0.0482 | 1.0000 |
| 14 | Oregon ==> price_0_50 & Willamette Valley | 0.0482 | 0.5604 |
| 15 | Willamette Valley ==> Oregon | 0.0593 | 1.0000 |
| 16 | Willamette Valley & Pinot Noir ==> Oregon | 0.0398 | 1.0000 |
| 17 | Willamette Valley & Pinot Noir & price_0_50 ==... | 0.0296 | 1.0000 |

| | | | |
|----|---|--------|--------|
| 18 | price_0_50 & Oregon ==> Willamette Valley | 0.0482 | 0.6586 |
| 19 | Willamette Valley ==> price_0_50 & Oregon | 0.0482 | 0.8122 |
| 20 | Willamette Valley & Pinot Noir ==> price_0_50 ... | 0.0296 | 0.7442 |
| 21 | Columbia Valley & 88 ==> Washington & price_0_50 | 0.0244 | 0.9751 |
| 22 | Washington & 88 ==> price_0_50 & Columbia Valley | 0.0244 | 0.9098 |
| 23 | Washington & Syrah ==> Columbia Valley | 0.0217 | 0.9616 |
| 24 | Washington & Cabernet Sauvignon ==> Columbia V... | 0.0241 | 0.9463 |
| 25 | price_0_50 & Columbia Valley & 88 ==> Washington | 0.0244 | 1.0000 |
| 26 | Columbia Valley & 90 ==> Washington | 0.0208 | 1.0000 |
| 27 | Washington ==> price_0_50 & Columbia Valley | 0.1398 | 0.8497 |
| 28 | Columbia Valley & 88 ==> Washington | 0.0250 | 1.0000 |
| 29 | Columbia Valley ==> Washington | 0.1545 | 1.0000 |
| 30 | price_0_50 & Columbia Valley ==> Washington | 0.1398 | 1.0000 |
| 31 | Cabernet Sauvignon & Columbia Valley ==> Washi... | 0.0241 | 1.0000 |
| 32 | Washington ==> Columbia Valley | 0.1545 | 0.9390 |
| 33 | Syrah & Columbia Valley ==> Washington | 0.0217 | 1.0000 |
| 34 | Columbia Valley ==> Washington & price_0_50 | 0.1398 | 0.9049 |
| 35 | price_0_50 & Washington ==> Columbia Valley | 0.1398 | 0.9362 |
| 36 | Washington & 90 ==> Columbia Valley | 0.0208 | 0.9359 |
| 37 | Washington & 88 ==> Columbia Valley | 0.0250 | 0.9330 |
| 38 | price_0_50 & Washington & 88 ==> Columbia Valley | 0.0244 | 0.9321 |
| 39 | Napa & price_50_100 ==> Cabernet Sauvignon & C... | 0.0311 | 0.6965 |
| 40 | Cabernet Sauvignon & California & price_50_100... | 0.0311 | 0.8101 |
| 41 | Cabernet Sauvignon & price_50_100 ==> Napa | 0.0311 | 0.7239 |
| 42 | Cabernet Sauvignon & price_50_100 ==> Napa & C... | 0.0311 | 0.7239 |
| 43 | Napa & California & price_50_100 ==> Cabernet ... | 0.0311 | 0.6965 |
| 44 | Napa & price_50_100 ==> Cabernet Sauvignon | 0.0311 | 0.6965 |
| 45 | Cabernet Sauvignon & California ==> Napa | 0.0650 | 0.5619 |
| 46 | Willamette Valley ==> price_0_50 & Pinot Noir | 0.0296 | 0.5000 |
| 47 | Willamette Valley & Oregon ==> price_0_50 & Pi... | 0.0296 | 0.5000 |
| 48 | Willamette Valley ==> Pinot Noir | 0.0398 | 0.6718 |
| 49 | Willamette Valley & Oregon ==> Pinot Noir | 0.0398 | 0.6718 |
| 50 | Willamette Valley & Oregon & price_0_50 ==> Pi... | 0.0296 | 0.6156 |
| 51 | Willamette Valley & price_0_50 ==> Pinot Noir | 0.0296 | 0.6156 |
| 52 | Oregon ==> Pinot Noir | 0.0450 | 0.5237 |
| 53 | Sierra Foothills ==> price_0_50 & California | 0.0276 | 0.9824 |
| 54 | California Other ==> price_0_50 & California | 0.0544 | 0.9783 |
| 55 | Central Coast & Chardonnay ==> price_0_50 & Ca... | 0.0345 | 0.9633 |
| 56 | Sonoma & Zinfandel ==> price_0_50 & California | 0.0230 | 0.9534 |
| 57 | 87 & Central Coast ==> price_0_50 & California | 0.0250 | 0.9486 |
| 58 | Zinfandel ==> price_0_50 & California | 0.0538 | 0.9422 |
| 59 | 87 & Sonoma ==> price_0_50 & California | 0.0225 | 0.9257 |
| 60 | Central Coast & 88 ==> price_0_50 & California | 0.0202 | 0.9170 |
| 61 | Central Coast ==> price_0_50 & California | 0.1907 | 0.8835 |
| 62 | Sonoma & Chardonnay ==> price_0_50 & California | 0.0297 | 0.8822 |
| 63 | Sauvignon Blanc ==> price_0_50 & California | 0.0342 | 0.8481 |
| 64 | 82 ==> price_0_50 & California | 0.0240 | 0.8462 |
| 65 | Napa-Sonoma ==> price_0_50 & California | 0.0210 | 0.8307 |
| 66 | Sonoma ==> price_0_50 & California | 0.1497 | 0.8216 |
| 67 | Sonoma ==> California | 0.1822 | 1.0000 |
| 68 | 87 & Sonoma ==> California | 0.0243 | 1.0000 |

| | | | | |
|-----|--|-------------------------|--------|--------|
| 69 | Central Coast & Chardonnay ==> | California | 0.0358 | 1.0000 |
| 70 | Central Coast ==> | California | 0.2159 | 1.0000 |
| 71 | 87 & Central Coast ==> | California | 0.0263 | 1.0000 |
| 72 | 92 & Central Coast ==> | California | 0.0201 | 1.0000 |
| 73 | price_0_50 & Sierra Foothills ==> | California | 0.0276 | 1.0000 |
| 74 | Sonoma & Chardonnay ==> | California | 0.0337 | 1.0000 |
| 75 | Central Coast & 88 ==> | California | 0.0220 | 1.0000 |
| 76 | price_0_50 & Napa-Sonoma ==> | California | 0.0210 | 1.0000 |
| 77 | Sonoma & 90 ==> | California | 0.0232 | 1.0000 |
| 78 | Sonoma & Zinfandel ==> | California | 0.0242 | 1.0000 |
| 79 | Central Coast & 90 ==> | California | 0.0211 | 1.0000 |
| 80 | Mendocino/Lake Counties ==> | California | 0.0215 | 1.0000 |
| 81 | Napa-Sonoma ==> | California | 0.0253 | 1.0000 |
| 82 | California Other ==> | California | 0.0556 | 1.0000 |
| 83 | price_0_50 & 87 & Central Coast ==> | California | 0.0250 | 1.0000 |
| 84 | price_0_50 & Sonoma & Zinfandel ==> | California | 0.0230 | 1.0000 |
| 85 | price_0_50 & Central Coast ==> | California | 0.1907 | 1.0000 |
| 86 | price_0_50 & 87 & Sonoma ==> | California | 0.0225 | 1.0000 |
| 87 | price_0_50 & Sonoma ==> | California | 0.1497 | 1.0000 |
| 88 | Sonoma & Pinot Noir ==> | California | 0.0509 | 1.0000 |
| 89 | price_0_50 & Central Coast & Chardonnay ==> | Ca... | 0.0345 | 1.0000 |
| 90 | Sierra Foothills ==> | California | 0.0281 | 1.0000 |
| 91 | price_0_50 & Sonoma & Chardonnay ==> | California | 0.0297 | 1.0000 |
| 92 | Napa & Cabernet Sauvignon & price_50_100 ==> | C... | 0.0311 | 1.0000 |
| 93 | Central Coast & Pinot Noir ==> | California | 0.0512 | 1.0000 |
| 94 | price_0_50 & Napa & Cabernet Sauvignon ==> | Cal... | 0.0237 | 1.0000 |
| 95 | price_0_50 & Central Coast & Pinot Noir ==> | Ca... | 0.0378 | 1.0000 |
| 96 | price_0_50 & Central Coast & 88 ==> | California | 0.0202 | 1.0000 |
| 97 | Cabernet Sauvignon & Sonoma ==> | California | 0.0204 | 1.0000 |
| 98 | price_0_50 & California Other ==> | California | 0.0544 | 1.0000 |
| 99 | Napa ==> | California | 0.1404 | 1.0000 |
| 100 | price_0_50 & Napa ==> | California | 0.0820 | 1.0000 |
| 101 | Napa & Cabernet Sauvignon ==> | California | 0.0650 | 1.0000 |
| 102 | Sonoma & price_50_100 ==> | California | 0.0312 | 1.0000 |
| 103 | Central Coast & price_50_100 ==> | California | 0.0245 | 1.0000 |
| 104 | Napa & price_50_100 ==> | California | 0.0447 | 1.0000 |
| 105 | price_0_50 & Sonoma & Pinot Noir ==> | California | 0.0328 | 1.0000 |
| 106 | 84 ==> | price_0_50 & California | 0.0527 | 0.8074 |
| 107 | Zinfandel ==> | California | 0.0556 | 0.9741 |
| 108 | price_0_50 & Zinfandel ==> | California | 0.0538 | 0.9736 |
| 109 | 83 ==> | price_0_50 & California | 0.0273 | 0.7832 |
| 110 | Central Coast & Pinot Noir ==> | price_0_50 & Ca... | 0.0378 | 0.7381 |
| 111 | Chardonnay ==> | price_0_50 & California | 0.0952 | 0.7368 |
| 112 | Cabernet Sauvignon & price_50_100 ==> | California | 0.0384 | 0.8936 |
| 113 | 82 ==> | California | 0.0246 | 0.8659 |
| 114 | price_0_50 & 82 ==> | California | 0.0240 | 0.8643 |
| 115 | Sauvignon Blanc ==> | California | 0.0343 | 0.8506 |
| 116 | price_0_50 & Sauvignon Blanc ==> | California | 0.0342 | 0.8502 |
| 117 | 85 ==> | price_0_50 & California | 0.0519 | 0.6957 |
| 118 | 84 ==> | California | 0.0551 | 0.8443 |
| 119 | 84 & price_0_50 ==> | California | 0.0527 | 0.8399 |

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| 120 | Sauvignon Blanc ==> | price_0_50 | 0.0402 | 0.9975 |
| 121 | California & Sauvignon Blanc ==> | price_0_50 | 0.0342 | 0.9971 |
| 122 | Finger Lakes & New York ==> | price_0_50 | 0.0292 | 0.9914 |
| 123 | Finger Lakes ==> | price_0_50 | 0.0292 | 0.9914 |
| 124 | Riesling ==> | price_0_50 | 0.0282 | 0.9911 |
| 125 | New York ==> | price_0_50 | 0.0452 | 0.9853 |
| 126 | Sierra Foothills & California ==> | price_0_50 | 0.0276 | 0.9824 |
| 127 | Sierra Foothills ==> | price_0_50 | 0.0276 | 0.9824 |
| 128 | 82 ==> | price_0_50 | 0.0278 | 0.9791 |
| 129 | California Other ==> | price_0_50 | 0.0544 | 0.9783 |
| 130 | California & California Other ==> | price_0_50 | 0.0544 | 0.9783 |
| 131 | California & 82 ==> | price_0_50 | 0.0240 | 0.9773 |
| 132 | Washington & 88 ==> | price_0_50 | 0.0261 | 0.9761 |
| 133 | 83 ==> | price_0_50 | 0.0340 | 0.9759 |
| 134 | Columbia Valley & 88 ==> | price_0_50 | 0.0244 | 0.9751 |
| 135 | Washington & Columbia Valley & 88 ==> | price_0_50 | 0.0244 | 0.9751 |
| 136 | 86 ==> | price_0_50 & California | 0.0611 | 0.6664 |
| 137 | California & 83 ==> | price_0_50 | 0.0273 | 0.9714 |
| 138 | 83 ==> | California | 0.0281 | 0.8063 |
| 139 | Zinfandel ==> | price_0_50 | 0.0552 | 0.9678 |
| 140 | California & Zinfandel ==> | price_0_50 | 0.0538 | 0.9673 |
| 141 | price_0_50 & 83 ==> | California | 0.0273 | 0.8025 |
| 142 | Central Coast & Chardonnay ==> | price_0_50 | 0.0345 | 0.9633 |
| 143 | Central Coast & California & Chardonnay ==> | pr... | 0.0345 | 0.9633 |
| 144 | price_50_100 ==> | California | 0.1096 | 0.8007 |
| 145 | Cabernet Sauvignon ==> | California | 0.1156 | 0.8007 |
| 146 | 84 ==> | price_0_50 | 0.0628 | 0.9614 |
| 147 | 85 ==> | price_0_50 | 0.0717 | 0.9605 |
| 148 | Chardonnay ==> | California | 0.1031 | 0.7977 |
| 149 | 84 & California ==> | price_0_50 | 0.0527 | 0.9564 |
| 150 | Sonoma & Zinfandel ==> | price_0_50 | 0.0230 | 0.9534 |
| 151 | Sonoma & California & Zinfandel ==> | price_0_50 | 0.0230 | 0.9534 |
| 152 | price_0_50 & Chardonnay ==> | California | 0.0952 | 0.7907 |
| 153 | 85 & California ==> | price_0_50 | 0.0519 | 0.9491 |
| 154 | 87 & Central Coast ==> | price_0_50 | 0.0250 | 0.9486 |
| 155 | 87 & California & Central Coast ==> | price_0_50 | 0.0250 | 0.9486 |
| 156 | 86 ==> | price_0_50 | 0.0865 | 0.9442 |
| 157 | Sonoma & Pinot Noir ==> | price_0_50 & California | 0.0328 | 0.6446 |
| 158 | 94 ==> | California | 0.0237 | 0.7769 |
| 159 | 87 ==> | price_0_50 | 0.1183 | 0.9330 |
| 160 | Merlot ==> | price_0_50 | 0.0480 | 0.9322 |
| 161 | Chardonnay ==> | price_0_50 | 0.1204 | 0.9319 |
| 162 | Pinot Noir & price_50_100 ==> | California | 0.0354 | 0.7730 |
| 163 | 86 & California ==> | price_0_50 | 0.0611 | 0.9278 |
| 164 | Washington & 90 ==> | price_0_50 | 0.0206 | 0.9274 |
| 165 | 87 & Sonoma & California ==> | price_0_50 | 0.0225 | 0.9257 |
| 166 | 87 & Sonoma ==> | price_0_50 | 0.0225 | 0.9257 |
| 167 | 87 ==> | price_0_50 & California | 0.0801 | 0.6316 |
| 168 | California & Chardonnay ==> | price_0_50 | 0.0952 | 0.9237 |
| 169 | 93 ==> | California | 0.0387 | 0.7663 |
| 170 | Merlot & California ==> | price_0_50 | 0.0301 | 0.9193 |

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|-----|--------------------------------------|-------------------------|--------|--------|
| 171 | Central Coast & 88 & California ==> | price_0_50 | 0.0202 | 0.9170 |
| 172 | Central Coast & 88 ==> | price_0_50 | 0.0202 | 0.9170 |
| 173 | 87 & California ==> | price_0_50 | 0.0801 | 0.9138 |
| 174 | 88 ==> | price_0_50 | 0.1056 | 0.9097 |
| 175 | Washington ==> | price_0_50 | 0.1493 | 0.9076 |
| 176 | Washington & Columbia Valley ==> | price_0_50 | 0.1398 | 0.9049 |
| 177 | Columbia Valley ==> | price_0_50 | 0.1398 | 0.9049 |
| 178 | Syrah & California ==> | price_0_50 | 0.0363 | 0.8956 |
| 179 | 89 ==> | price_0_50 | 0.0667 | 0.8931 |
| 180 | price_0_50 & 93 ==> | California | 0.0211 | 0.7382 |
| 181 | price_0_50 & Cabernet Sauvignon ==> | California | 0.0664 | 0.7358 |
| 182 | Central Coast & California ==> | price_0_50 | 0.1907 | 0.8835 |
| 183 | Central Coast ==> | price_0_50 | 0.1907 | 0.8835 |
| 184 | Sonoma & Chardonnay ==> | price_0_50 | 0.0297 | 0.8822 |
| 185 | Sonoma & California & Chardonnay ==> | price_0_50 | 0.0297 | 0.8822 |
| 186 | 92 ==> | California | 0.0567 | 0.7331 |
| 187 | 85 ==> | California | 0.0547 | 0.7330 |
| 188 | Syrah ==> | price_0_50 | 0.0580 | 0.8771 |
| 189 | Red Blend ==> | price_0_50 | 0.0464 | 0.8739 |
| 190 | price_0_50 & 85 ==> | California | 0.0519 | 0.7242 |
| 191 | Pinot Noir ==> | California | 0.1249 | 0.7228 |
| 192 | 88 & California ==> | price_0_50 | 0.0609 | 0.8682 |
| 193 | California & 89 ==> | price_0_50 | 0.0371 | 0.8648 |
| 194 | 86 ==> | California | 0.0658 | 0.7182 |
| 195 | Napa ==> | price_0_50 & California | 0.0820 | 0.5844 |
| 196 | Merlot ==> | price_0_50 & California | 0.0301 | 0.5832 |
| 197 | Red Blend & California ==> | price_0_50 | 0.0265 | 0.8519 |
| 198 | Oregon ==> | price_0_50 | 0.0731 | 0.8509 |
| 199 | 92 & price_0_50 ==> | California | 0.0377 | 0.7065 |
| 200 | price_0_50 & 86 ==> | California | 0.0611 | 0.7057 |
| 201 | price_0_50 & Pinot Noir ==> | California | 0.0890 | 0.7053 |
| 202 | 90 ==> | price_0_50 | 0.0953 | 0.8398 |
| 203 | California & Napa-Sonoma ==> | price_0_50 | 0.0210 | 0.8307 |
| 204 | Napa-Sonoma ==> | price_0_50 | 0.0210 | 0.8307 |
| 205 | 87 ==> | California | 0.0876 | 0.6911 |
| 206 | Sonoma & California ==> | price_0_50 | 0.1497 | 0.8216 |
| 207 | Sonoma ==> | price_0_50 | 0.1497 | 0.8216 |
| 208 | California ==> | price_0_50 | 0.5778 | 0.8211 |
| 209 | price_0_50 ==> | California | 0.5778 | 0.6834 |
| 210 | Washington & Cabernet Sauvignon ==> | price_0_50 | 0.0208 | 0.8162 |
| 211 | price_0_50 & 87 ==> | California | 0.0801 | 0.6769 |
| 212 | Willamette Valley & Oregon ==> | price_0_50 | 0.0482 | 0.8122 |
| 213 | Willamette Valley ==> | price_0_50 | 0.0482 | 0.8122 |
| 214 | 90 ==> | California | 0.0765 | 0.6738 |
| 215 | California & 90 ==> | price_0_50 | 0.0616 | 0.8059 |
| 216 | Syrah ==> | price_0_50 & California | 0.0363 | 0.5483 |
| 217 | 90 ==> | price_0_50 & California | 0.0616 | 0.5431 |
| 218 | 91 ==> | price_0_50 | 0.0645 | 0.7859 |
| 219 | price_0_50 & 90 ==> | California | 0.0616 | 0.6467 |
| 220 | 88 ==> | price_0_50 & California | 0.0609 | 0.5246 |
| 221 | Oregon & Pinot Noir ==> | price_0_50 | 0.0343 | 0.7628 |

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| 222 | Merlot ==> California | 0.0327 | 0.6344 |
| 223 | 91 ==> California | 0.0517 | 0.6306 |
| 224 | Pinot Noir ==> price_0_50 & California | 0.0890 | 0.5150 |
| 225 | price_0_50 & Merlot ==> California | 0.0301 | 0.6257 |
| 226 | price_0_50 & Syrah ==> California | 0.0363 | 0.6251 |
| 227 | California & 91 ==> price_0_50 | 0.0387 | 0.7469 |
| 228 | Willamette Valley & Oregon & Pinot Noir ==> pr... | 0.0296 | 0.7442 |
| 229 | Willamette Valley & Pinot Noir ==> price_0_50 | 0.0296 | 0.7442 |
| 230 | Central Coast & California & Pinot Noir ==> pr... | 0.0378 | 0.7381 |
| 231 | Central Coast & Pinot Noir ==> price_0_50 | 0.0378 | 0.7381 |
| 232 | Syrah ==> California | 0.0405 | 0.6122 |
| 233 | Pinot Noir ==> price_0_50 | 0.1262 | 0.7302 |
| 234 | 88 ==> California | 0.0702 | 0.6042 |
| 235 | price_0_50 & 91 ==> California | 0.0387 | 0.5992 |
| 236 | California & Pinot Noir ==> price_0_50 | 0.0890 | 0.7124 |
| 237 | Red Blend ==> California | 0.0311 | 0.5856 |
| 238 | price_0_50 & 88 ==> California | 0.0609 | 0.5767 |
| 239 | 92 ==> price_0_50 | 0.0533 | 0.6894 |
| 240 | 89 ==> California | 0.0428 | 0.5734 |
| 241 | Red Blend & price_0_50 ==> California | 0.0265 | 0.5709 |
| 242 | price_0_50 & 89 ==> California | 0.0371 | 0.5552 |
| 243 | 92 & California ==> price_0_50 | 0.0377 | 0.6644 |
| 244 | Sonoma & Pinot Noir ==> price_0_50 | 0.0328 | 0.6446 |
| 245 | Sonoma & Pinot Noir & California ==> price_0_50 | 0.0328 | 0.6446 |
| 246 | Cabernet Sauvignon ==> price_0_50 | 0.0902 | 0.6245 |
| 247 | Napa & California ==> price_0_50 | 0.0820 | 0.5844 |
| 248 | Napa ==> price_0_50 | 0.0820 | 0.5844 |
| 249 | Cabernet Sauvignon & California ==> price_0_50 | 0.0664 | 0.5739 |
| 250 | 93 ==> price_0_50 | 0.0285 | 0.5645 |
| 251 | 93 & California ==> price_0_50 | 0.0211 | 0.5438 |

| | lift | leverage |
|----|---------|----------|
| 0 | 21.9390 | 0.0279 |
| 1 | 21.9390 | 0.0279 |
| 2 | 21.8024 | 0.0281 |
| 3 | 21.8024 | 0.0281 |
| 4 | 21.8024 | 0.0279 |
| 5 | 21.8024 | 0.0279 |
| 6 | 14.9261 | 0.0372 |
| 7 | 14.9261 | 0.0372 |
| 8 | 14.5626 | 0.0276 |
| 9 | 14.5626 | 0.0276 |
| 10 | 13.6768 | 0.0275 |
| 11 | 13.6768 | 0.0275 |
| 12 | 11.6360 | 0.0542 |
| 13 | 11.6360 | 0.0440 |
| 14 | 11.6360 | 0.0440 |
| 15 | 11.6360 | 0.0542 |
| 16 | 11.6360 | 0.0364 |
| 17 | 11.6360 | 0.0271 |
| 18 | 11.1066 | 0.0438 |

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| 19 | 11.1066 | 0.0438 |
| 20 | 10.1770 | 0.0267 |
| 21 | 6.5291 | 0.0206 |
| 22 | 6.5071 | 0.0206 |
| 23 | 6.2235 | 0.0182 |
| 24 | 6.1243 | 0.0202 |
| 25 | 6.0770 | 0.0203 |
| 26 | 6.0770 | 0.0174 |
| 27 | 6.0770 | 0.1168 |
| 28 | 6.0770 | 0.0209 |
| 29 | 6.0770 | 0.1291 |
| 30 | 6.0770 | 0.1168 |
| 31 | 6.0770 | 0.0201 |
| 32 | 6.0770 | 0.1291 |
| 33 | 6.0770 | 0.0181 |
| 34 | 6.0590 | 0.1167 |
| 35 | 6.0590 | 0.1167 |
| 36 | 6.0572 | 0.0174 |
| 37 | 6.0386 | 0.0208 |
| 38 | 6.0324 | 0.0203 |
| 39 | 6.0237 | 0.0260 |
| 40 | 5.7708 | 0.0257 |
| 41 | 5.1567 | 0.0251 |
| 42 | 5.1567 | 0.0251 |
| 43 | 4.8230 | 0.0247 |
| 44 | 4.8230 | 0.0247 |
| 45 | 4.0024 | 0.0487 |
| 46 | 3.9624 | 0.0222 |
| 47 | 3.9624 | 0.0222 |
| 48 | 3.8875 | 0.0296 |
| 49 | 3.8875 | 0.0296 |
| 50 | 3.5622 | 0.0213 |
| 51 | 3.5622 | 0.0213 |
| 52 | 3.0306 | 0.0302 |
| 53 | 1.7003 | 0.0114 |
| 54 | 1.6933 | 0.0223 |
| 55 | 1.6673 | 0.0138 |
| 56 | 1.6502 | 0.0091 |
| 57 | 1.6420 | 0.0098 |
| 58 | 1.6309 | 0.0208 |
| 59 | 1.6023 | 0.0084 |
| 60 | 1.5872 | 0.0075 |
| 61 | 1.5292 | 0.0660 |
| 62 | 1.5269 | 0.0103 |
| 63 | 1.4680 | 0.0109 |
| 64 | 1.4647 | 0.0076 |
| 65 | 1.4379 | 0.0064 |
| 66 | 1.4220 | 0.0444 |
| 67 | 1.4212 | 0.0540 |
| 68 | 1.4212 | 0.0072 |
| 69 | 1.4212 | 0.0106 |

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| 70 | 1.4212 | 0.0640 |
| 71 | 1.4212 | 0.0078 |
| 72 | 1.4212 | 0.0060 |
| 73 | 1.4212 | 0.0082 |
| 74 | 1.4212 | 0.0100 |
| 75 | 1.4212 | 0.0065 |
| 76 | 1.4212 | 0.0062 |
| 77 | 1.4212 | 0.0069 |
| 78 | 1.4212 | 0.0072 |
| 79 | 1.4212 | 0.0063 |
| 80 | 1.4212 | 0.0064 |
| 81 | 1.4212 | 0.0075 |
| 82 | 1.4212 | 0.0165 |
| 83 | 1.4212 | 0.0074 |
| 84 | 1.4212 | 0.0068 |
| 85 | 1.4212 | 0.0565 |
| 86 | 1.4212 | 0.0067 |
| 87 | 1.4212 | 0.0444 |
| 88 | 1.4212 | 0.0151 |
| 89 | 1.4212 | 0.0102 |
| 90 | 1.4212 | 0.0083 |
| 91 | 1.4212 | 0.0088 |
| 92 | 1.4212 | 0.0092 |
| 93 | 1.4212 | 0.0152 |
| 94 | 1.4212 | 0.0070 |
| 95 | 1.4212 | 0.0112 |
| 96 | 1.4212 | 0.0060 |
| 97 | 1.4212 | 0.0060 |
| 98 | 1.4212 | 0.0161 |
| 99 | 1.4212 | 0.0416 |
| 100 | 1.4212 | 0.0243 |
| 101 | 1.4212 | 0.0193 |
| 102 | 1.4212 | 0.0092 |
| 103 | 1.4212 | 0.0073 |
| 104 | 1.4212 | 0.0132 |
| 105 | 1.4212 | 0.0097 |
| 106 | 1.3975 | 0.0150 |
| 107 | 1.3844 | 0.0154 |
| 108 | 1.3836 | 0.0149 |
| 109 | 1.3557 | 0.0072 |
| 110 | 1.2776 | 0.0082 |
| 111 | 1.2754 | 0.0206 |
| 112 | 1.2700 | 0.0082 |
| 113 | 1.2306 | 0.0046 |
| 114 | 1.2283 | 0.0045 |
| 115 | 1.2089 | 0.0059 |
| 116 | 1.2083 | 0.0059 |
| 117 | 1.2041 | 0.0088 |
| 118 | 1.1998 | 0.0092 |
| 119 | 1.1936 | 0.0086 |
| 120 | 1.1799 | 0.0061 |

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| 121 | 1.1794 | 0.0052 |
| 122 | 1.1727 | 0.0043 |
| 123 | 1.1727 | 0.0043 |
| 124 | 1.1724 | 0.0041 |
| 125 | 1.1654 | 0.0064 |
| 126 | 1.1620 | 0.0038 |
| 127 | 1.1620 | 0.0038 |
| 128 | 1.1581 | 0.0038 |
| 129 | 1.1572 | 0.0074 |
| 130 | 1.1572 | 0.0074 |
| 131 | 1.1560 | 0.0032 |
| 132 | 1.1546 | 0.0035 |
| 133 | 1.1544 | 0.0045 |
| 134 | 1.1534 | 0.0032 |
| 135 | 1.1534 | 0.0032 |
| 136 | 1.1534 | 0.0081 |
| 137 | 1.1491 | 0.0035 |
| 138 | 1.1458 | 0.0036 |
| 139 | 1.1448 | 0.0070 |
| 140 | 1.1441 | 0.0068 |
| 141 | 1.1406 | 0.0034 |
| 142 | 1.1394 | 0.0042 |
| 143 | 1.1394 | 0.0042 |
| 144 | 1.1380 | 0.0133 |
| 145 | 1.1379 | 0.0140 |
| 146 | 1.1372 | 0.0076 |
| 147 | 1.1362 | 0.0086 |
| 148 | 1.1337 | 0.0122 |
| 149 | 1.1312 | 0.0061 |
| 150 | 1.1277 | 0.0026 |
| 151 | 1.1277 | 0.0026 |
| 152 | 1.1237 | 0.0105 |
| 153 | 1.1227 | 0.0057 |
| 154 | 1.1221 | 0.0027 |
| 155 | 1.1221 | 0.0027 |
| 156 | 1.1169 | 0.0091 |
| 157 | 1.1158 | 0.0034 |
| 158 | 1.1042 | 0.0022 |
| 159 | 1.1036 | 0.0111 |
| 160 | 1.1026 | 0.0045 |
| 161 | 1.1023 | 0.0112 |
| 162 | 1.0986 | 0.0032 |
| 163 | 1.0975 | 0.0054 |
| 164 | 1.0970 | 0.0018 |
| 165 | 1.0950 | 0.0019 |
| 166 | 1.0950 | 0.0019 |
| 167 | 1.0931 | 0.0068 |
| 168 | 1.0926 | 0.0081 |
| 169 | 1.0891 | 0.0032 |
| 170 | 1.0873 | 0.0024 |
| 171 | 1.0847 | 0.0016 |

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| 172 | 1.0847 | 0.0016 |
| 173 | 1.0809 | 0.0060 |
| 174 | 1.0760 | 0.0075 |
| 175 | 1.0735 | 0.0102 |
| 176 | 1.0704 | 0.0092 |
| 177 | 1.0704 | 0.0092 |
| 178 | 1.0594 | 0.0020 |
| 179 | 1.0564 | 0.0036 |
| 180 | 1.0492 | 0.0010 |
| 181 | 1.0457 | 0.0029 |
| 182 | 1.0450 | 0.0082 |
| 183 | 1.0450 | 0.0082 |
| 184 | 1.0435 | 0.0012 |
| 185 | 1.0435 | 0.0012 |
| 186 | 1.0419 | 0.0023 |
| 187 | 1.0417 | 0.0022 |
| 188 | 1.0375 | 0.0021 |
| 189 | 1.0337 | 0.0015 |
| 190 | 1.0293 | 0.0015 |
| 191 | 1.0273 | 0.0033 |
| 192 | 1.0270 | 0.0016 |
| 193 | 1.0229 | 0.0008 |
| 194 | 1.0207 | 0.0013 |
| 195 | 1.0115 | 0.0009 |
| 196 | 1.0095 | 0.0003 |
| 197 | 1.0076 | 0.0002 |
| 198 | 1.0065 | 0.0005 |
| 199 | 1.0041 | 0.0002 |
| 200 | 1.0030 | 0.0002 |
| 201 | 1.0023 | 0.0002 |
| 202 | 0.9933 | -0.0006 |
| 203 | 0.9826 | -0.0004 |
| 204 | 0.9826 | -0.0004 |
| 205 | 0.9822 | -0.0016 |
| 206 | 0.9718 | -0.0043 |
| 207 | 0.9718 | -0.0043 |
| 208 | 0.9712 | -0.0171 |
| 209 | 0.9712 | -0.0171 |
| 210 | 0.9654 | -0.0007 |
| 211 | 0.9620 | -0.0032 |
| 212 | 0.9607 | -0.0020 |
| 213 | 0.9607 | -0.0020 |
| 214 | 0.9576 | -0.0034 |
| 215 | 0.9533 | -0.0030 |
| 216 | 0.9490 | -0.0019 |
| 217 | 0.9400 | -0.0039 |
| 218 | 0.9296 | -0.0049 |
| 219 | 0.9191 | -0.0054 |
| 220 | 0.9080 | -0.0062 |
| 221 | 0.9023 | -0.0037 |
| 222 | 0.9017 | -0.0036 |

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| 223 | 0.8962 | -0.0060 |
| 224 | 0.8913 | -0.0109 |
| 225 | 0.8892 | -0.0037 |
| 226 | 0.8884 | -0.0046 |
| 227 | 0.8834 | -0.0051 |
| 228 | 0.8803 | -0.0040 |
| 229 | 0.8803 | -0.0040 |
| 230 | 0.8731 | -0.0055 |
| 231 | 0.8731 | -0.0055 |
| 232 | 0.8701 | -0.0060 |
| 233 | 0.8637 | -0.0199 |
| 234 | 0.8587 | -0.0115 |
| 235 | 0.8516 | -0.0067 |
| 236 | 0.8427 | -0.0166 |
| 237 | 0.8323 | -0.0063 |
| 238 | 0.8196 | -0.0134 |
| 239 | 0.8154 | -0.0121 |
| 240 | 0.8148 | -0.0097 |
| 241 | 0.8114 | -0.0062 |
| 242 | 0.7891 | -0.0099 |
| 243 | 0.7859 | -0.0103 |
| 244 | 0.7625 | -0.0102 |
| 245 | 0.7625 | -0.0102 |
| 246 | 0.7387 | -0.0319 |
| 247 | 0.6912 | -0.0366 |
| 248 | 0.6912 | -0.0366 |
| 249 | 0.6788 | -0.0314 |
| 250 | 0.6677 | -0.0142 |
| 251 | 0.6433 | -0.0117 |

4.结论

预处理结果

预处理过后所剩的数据的country均为US

频繁项结果分析

- 1、价格：在50以内的葡萄酒占总数的约85%
- 2、价格：在50~100的葡萄酒占总数的约14%
- 3、价格：超过100的葡萄酒占总数的约1%
- 4、产地：70%的葡萄酒来自California
- 5、产地：16%的葡萄酒来自Washington
- 6、价格-产地：价格<50的葡萄酒中，约68%的葡萄酒来自California，约18%的葡萄酒来自Washington；约17%的葡萄酒是由Pinot Noir制造

7、价格-评分：评分为87的葡萄酒中约90%的价格<50，评分为88的葡萄酒中约91%的价格<50，评分为90的葡萄酒中约84%的价格<50

关联规则

- 1、99%由Sauvignon Blanc、Riesling酿造的葡萄酒的价格在50以内；
- 2、约98%的评分为82、83的葡萄酒的价格<50
- 3、约96%的评分为84、85的葡萄酒的价格<50
- 4、约89%的评分为89的葡萄酒的价格<50

可以得出结论：随着评分的提升，葡萄酒价格在50以内的占比越来越少。即随着评分提高，葡萄酒的价格也相对提升；符合客观常识。

