数据挖掘作业q2

作者：王星洲

学号：1652977

步骤一

```
# 读入数据所序列
row_data = pd.read_csv("F:/CourseData/数据挖掘/datamining20/trade_new.csv")
df1 = row_data[["vipno", "pluno", "amt"]]
df2 = row_data[["vipno", "pluno", "amt"]]
df3 = row_data[["vipno", "pluno", "amt"]]
df4 = row_data[["vipno", "pluno", "amt"]]
df1["pluno"] = (df1["pluno"]/1000000).astype(int)
df2["pluno"] = (df2["pluno"]/100000).astype(int)
df3["pluno"] = (df3["pluno"]/10000).astype(int)
df4["pluno"] = (df4["pluno"]/1000).astype(int)
df1 = df1.sort_values(by=["vipno"])
vipno_series = df1["vipno"].drop_duplicates()
vipno_series = vipno_series.reset_index(drop=True)
print(vipno_series)
df1 = df1.sort_values(by=["pluno"])
pluno_series1 = df1["pluno"].drop_duplicates()
pluno_series1 = pluno_series1.reset_index(drop=True)
print(pluno_series1)
df2 = df2.sort_values(by=["pluno"])
pluno_series2 = df2["pluno"].drop_duplicates()
pluno_series2 = pluno_series2.reset_index(drop=True)
print(pluno_series2)
df3 = df3.sort_values(by=["pluno"])
pluno_series3 = df3["pluno"].drop_duplicates()
pluno_series3 = pluno_series3.reset_index(drop=True)
print(pluno_series3)
df4 = df4.sort_values(by=["pluno"])
pluno_series4 = df4["pluno"].drop_duplicates()
pluno_series4 = pluno_series4.reset_index(drop=True)
print(pluno_series4)
# 分组，求和
group_data1 = df1.groupby(["vipno","pluno"])["amt"].sum()
group_data2 = df2.groupby(["vipno","pluno"])["amt"].sum()
group_data3 = df3.groupby(["vipno","pluno"])["amt"].sum()
group_data4 = df4.groupby(["vipno","pluno"])["amt"].sum()
print(group_data1)
```

运行结果：

vipno	pluno	
781924	10	12.30
	11	72.20
	14	63.47
	15	151.70
	23	18.00
	34	15.00
13325038116	10	1272.00
	14	5.60
	15	98.50
	22	27.54
	23	125.00
	24	12.68
	27	28.81
13854627199	14	190.87
	22	196.03
	23	28.00

步骤二

```python
#记录：用户486个，plu一级18个，plu二级94个，plu三级329个，plu四级979个
def jaccard_dist(a, b):
    fenzi = 0
    fenmu = 0
    for i in range(0,18):
        fenzi += min(a[i],b[i])
        fenmu += max(a[i],b[i])
    sim1 = fenzi/fenmu
    fenzi = 0
    fenmu = 0
    for i in range(18,18+94):
        fenzi += min(a[i],b[i])
        fenmu += max(a[i],b[i])
    sim2 = fenzi/fenmu
    fenzi = 0
    fenmu = 0
    for i in range(18+94,18+94+329):
        fenzi += min(a[i],b[i])
        fenmu += max(a[i],b[i])
    sim3 = fenzi/fenmu
    fenzi = 0
    fenmu = 0
    for i in range(18+94+329,18+94+329+979):
        fenzi += min(a[i],b[i])
        fenmu += max(a[i],b[i])
    sim4 = fenzi/fenmu
    return 1-(sim1+sim2+sim3+sim4)/4
```

步骤三

```python
def initCentroids(dataSet, k):#dataSet-数据点数组 k-设置的质心数
```

```
    #初始化质心
    numSamples, dim = dataSet.shape#numSample-数据点个数 dim-数据点维数
    #shape返回一个关于数组长宽的数组
    centroids = np.zeros((k, dim))#centroids-存放质心的数组
    index = random.sample(range(0, numSamples), k)#index-在零到数据点个数间的随机数
    print(index)
    for i in range(len(index)):
        centroids[i, :] = dataSet.values[index[i], :]
    #将随机质心存储入centroids
    return centroids

def CP(label, k, centroids, dataSet):
    cpnum = 0
    for i in range(k):
        distance = 0
        num = 0
        for j in range((len(label))):
            if label[j] == i:
                distance += jaccard_dist(dataSet.values[j,:],centroids[i,:])
                num += 1
        cpnum += distance/num
    return cpnum/k


def getCentroid(dataSet):
    div = len(dataSet)
    return sum(dataSet)/div


def getSC(dataSet, label):
    sum_number = 0
    k = len(label)
    for i in range(k):
        ai = 0
        bi = 0
        anum = 0
        bnum = 0
        for j in range(k):
            if label[i]==label[j]:
                ai += jaccard_dist(dataSet.values[i,:],dataSet.values[j,:])
                anum += 1
            else:
                bi += jaccard_dist(dataSet.values[i,:],dataSet.values[j,:])
                bnum += 1
        ai = ai / anum
        bi = bi / bnum
        sum_number += (bi - ai) / max(ai, bi)
    return sum_number / k


def kmeans(dataSet, k):
    #k-means算法的核心函数
    numSamples = dataSet.shape[0]#数据点个数为数据点数组的行数
    label=np.zeros(dataSet.shape[0])
```

```
    clusterChanged = True#clusterChanged-表示是否需要重新分组的布尔值判定量

    centroids = initCentroids(dataSet, k)#初始化质心

    while clusterChanged:#需要重新分组时
        clusterChanged = False#重置判定量为假
        for i in range(numSamples):#遍历所有数据点
            minDist = 100000.0#minDist-最小的数据点与质心的距离
            minIndex = 0#minIndex-最小的链接地址
            for j in range(k):
                #计算每个数据点到哪个质心的距离最小，及记录是哪一个质心
                distance = jaccard_dist(centroids[j, :], dataSet.values[i, :])#distance-暂时存放数据点到质心的距离，这里是jaccard距离
                if distance < minDist:
                    minDist = distance
                    minIndex = j
            if label[i] != minIndex:#当该数据点所隶属的质心与最小链接地址不同时更新点中的数据
                clusterChanged = True#重置判定量为真
                label[i] = minIndex#该数据点的第二列变为一个数组
        for j in range(k):#由新的隶属关系中更新质心位置
            pointsInCluster = []
            for m in range(len(label)):
                if label[m]==j:
                    pointsInCluster.append(dataSet.values[m, :])
            centroids[j, :] = getCentroid(pointsInCluster)
        print(label)
    print("分类完成")
    #这里计算SC
    silhouette_score = getSC(data, label)
    #这里计算CP
    compactness_score = CP(label,k,centroids,dataSet)
    print("sc:" + str(silhouette_score))
    print("cp:" + str(compactness_score))
    return silhouette_score,compactness_score


#数据准备
data1 = DataFrame(0, columns=pluno_series1, index=vipno_series)
# print(data)
for i in df1.index:
    vipno = df1['vipno'][i]
    pluno = df1['pluno'][i]
    amt = group_data1[vipno][pluno]
    if math.isnan(data1[pluno][vipno]):
        data1[pluno][vipno] = amt
    else:
        data1[pluno][vipno] += amt
data2 = DataFrame(0, columns=pluno_series2, index=vipno_series)
# print(data)
for i in df2.index:
    vipno = df2['vipno'][i]
    pluno = df2['pluno'][i]
    amt = group_data2[vipno][pluno]
    if math.isnan(data2[pluno][vipno]):
        data2[pluno][vipno] = amt
    else:
        data2[pluno][vipno] += amt
```

```
data3 = DataFrame(0, columns=pluno_series3, index=vipno_series)
# print(data)
for i in df1.index:
    vipno = df3['vipno'][i]
    pluno = df3['pluno'][i]
    amt = group_data3[vipno][pluno]
    if math.isnan(data3[pluno][vipno]):
        data3[pluno][vipno] = amt
    else:
        data3[pluno][vipno] += amt
data4 = DataFrame(0, columns=pluno_series4, index=vipno_series)
# print(data)
for i in df4.index:
    vipno = df4['vipno'][i]
    pluno = df4['pluno'][i]
    amt = group_data4[vipno][pluno]
    if math.isnan(data4[pluno][vipno]):
        data4[pluno][vipno] = amt
    else:
        data4[pluno][vipno] += amt
data = pd.concat([data1, data2, data3, data4],axis=1)


silhouette_score_array = []
for i in range(2,40):#从K为2到K为39，尝试一下
    silhouette_score_array.append(kmeans(data, i))
```

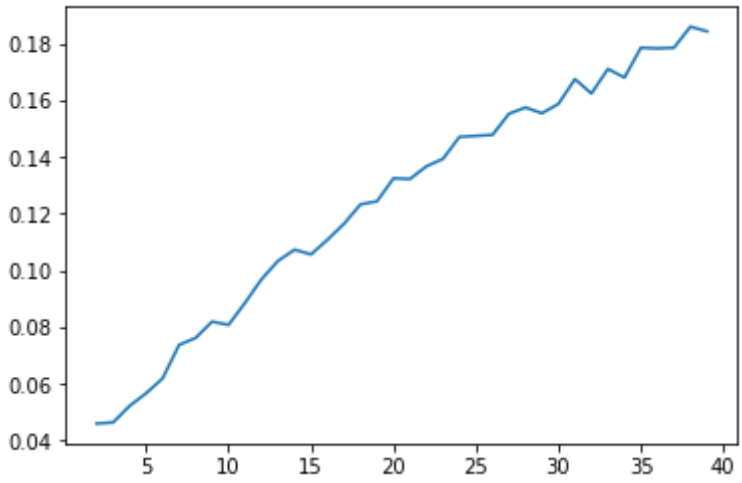
运行结果：

```
[(0.046009060242664455, 0.8703314634660553), (0.04639800140986168,
0.8507745782471007), (0.05223778588281045, 0.8456376368168257),
(0.0566935590430981, 0.8431493097538644), (0.06192274837863743,
0.8381479902059875), (0.07376180474905145, 0.8213263839704223),
(0.07619498835114803, 0.8275969889541755), (0.08196899003053335,
0.8183985455356022), (0.08084097548653246, 0.8227424299647964),
(0.08860153147888537, 0.823448835207196), (0.09692827131098074,
0.8059556649567884), (0.10340349963964743, 0.804504663043267),
(0.10734198666238734, 0.795502089742313), (0.10567994045519696,
0.8000799221307303), (0.11088282728752352, 0.7987122184817311),
(0.11648661299222518, 0.7925162285447176), (0.12333206200997812,
0.7843122079991169), (0.12441300679296502, 0.7877305175020182),
(0.13252647848121082, 0.7833612522715192), (0.13229130338814887,
0.7103942757034106), (0.13677147198394154, 0.7354396374295498),
(0.13937959430553268, 0.7729682405904812), (0.14715264498363456,
0.7618160925415621), (0.147492899268557, 0.7668674654821456),
(0.14784667225537074, 0.7691730476012262), (0.1552782580506372,
0.7601830177832005), (0.15751860731467987, 0.7589987317722463),
(0.15546415700476252, 0.7367407975129647), (0.15877971943254068,
0.7579979619890335), (0.16751464692397214, 0.7347685734583977),
(0.16244209603561277, 0.7228220673242257), (0.1711096423479383,
0.7272031881809556), (0.16806317873181773, 0.7289864361421701),
(0.17860849824890354, 0.7394203609998274), (0.1783595849139852,
0.7344277601077048), (0.1785540606823688, 0.7393803836497161),
(0.18602698564752815, 0.7397692607809426), (0.1843704923390654,
0.7173760381444888)]
```

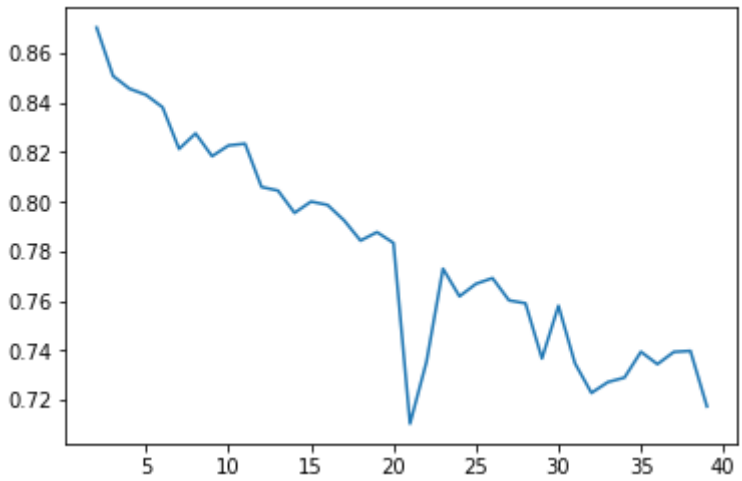
K	SC	CP
2	0.046009	0.870331
3	0.046398	0.850775
4	0.052238	0.845638
5	0.056694	0.843149
6	0.061923	0.838148
7	0.073762	0.821326
8	0.076195	0.827597
9	0.081969	0.818399
10	0.080841	0.822742
11	0.088602	0.823449
12	0.096928	0.805956
13	0.103403	0.804505
14	0.107342	0.795502
15	0.105680	0.800080
16	0.110883	0.798712
17	0.116487	0.792516
18	0.123332	0.784312
19	0.124413	0.787731
20	0.132526	0.783361
21	0.132291	0.710394
22	0.136771	0.735440
23	0.139380	0.772968
24	0.147153	0.761816
25	0.147493	0.766867
26	0.147847	0.769173
27	0.155278	0.760183
28	0.157519	0.758999
29	0.155464	0.736741
30	0.158780	0.757998
31	0.167515	0.734769

K	SC	CP
32	0.162442	0.722822
33	0.171110	0.727203
34	0.168063	0.728986
35	0.178608	0.739420
36	0.178360	0.734428
37	0.178554	0.739380
38	0.186027	0.739769
39	0.184370	0.717376

SC图像



CP图像



结论

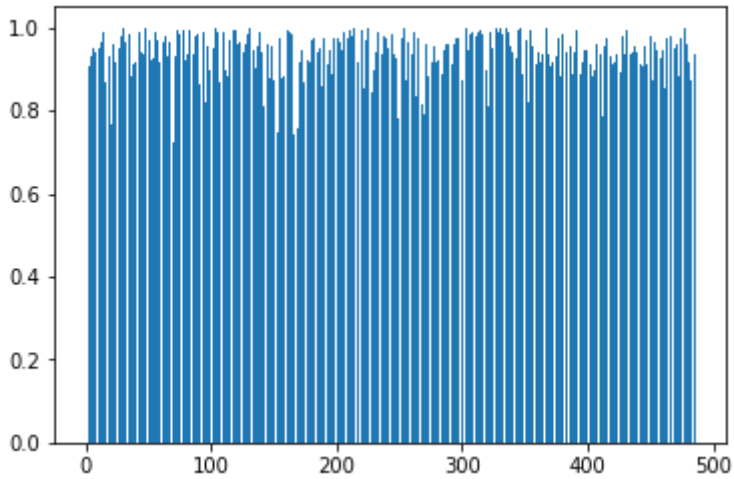
可以看到SC和CP的走向和第一种方法差不多，不过由于这次的计算时间要超过第一次，所以我就选取了k=2~k=39，结论一样，随着k的增大，聚类的效果也在变好。于是我又尝试着寻找拐点：

```
#in
test_sc_cp = kmeans(data, 200)
#out
分类完成
sc:0.5262420540508803
cp:0.3665441372058841

#in
test_sc_cp = kmeans(data, 300)
#out
分类完成
sc:0.7012315838613726
cp:0.20827258099201829
```

可以看到，在k等于300时，仍然没有发现拐点，而聚类将类别划分得这么细已经没有实际意义。所以我尝试着寻找原因，同样使用了距离分布表：

```
distance = []
for i in range(len(data)):
    distance.append(jaccard_dist(data.values[0,:], data.values[i,:]))
plt.bar(range(len(data)), distance)
```



大体上和第一种方法差不多，大部分距离都分布在1附近，不过已经照比1方法强了很多，可以看到还是有不少点间距离达到0.8以下的。不过作为kmeans算法的距离，太过于敏感了，这么大的距离就意味着聚在一起会严重影响评价，所以效果虽然强于第一种，但仍然不推荐。