hl-example

May 30, 2024

Hierarchical clustering- example

Mental health is an important aspect of the process of individual adaptation and development. Well-being is a positive mental health indicators that can be defined as an effect of the cognitive and emotional assessment of one's own life, consisting of a high level of fulfilment in multiple areas.

Another significant role in determining one's mental health is resilience. Resilience might be seen as a personality trait—a positive, distinct feature of an individual that mitigates the negative effects of stress and minimises episodes of depression . Resilience has also been conceptualised as a process that encompasses positive adaptation within the context of adversity.

The aim of this project is to cluster the participants by using the `Hierarchical clustering algorithm`.

We utilized a preexisting dataset provided by Konaszewski et al. (Konaszewski K, Niesiobędzka M, Surzykiewicz J. Resilience and mental health among juveniles: role of strategies for coping with stress. Health Qual Life Outcomes. 2021 Feb 18;19(1):58) https://doi.org/10.3886/E120001V1. They investigate the direct and indirect role of resilience in shaping the mental health of juveniles. The dataset includes `resilience`, `well-being` and 14 `coping strategies`.

[ ]:
```
# Importing the libraries
import numpy as np
import pandas as pd
import pyreadstat
import seaborn as sns
import matplotlib.pyplot as plt
import scipy.cluster.hierarchy as shc
from sklearn.cluster import AgglomerativeClustering
import warnings
warnings.filterwarnings('ignore')
```

[9]:
```
df, meta=pyreadstat.read_sav('konzas2.sav')
```

[13]:
```
df=df.dropna()
```

[14]:
```
df.head(3)
```

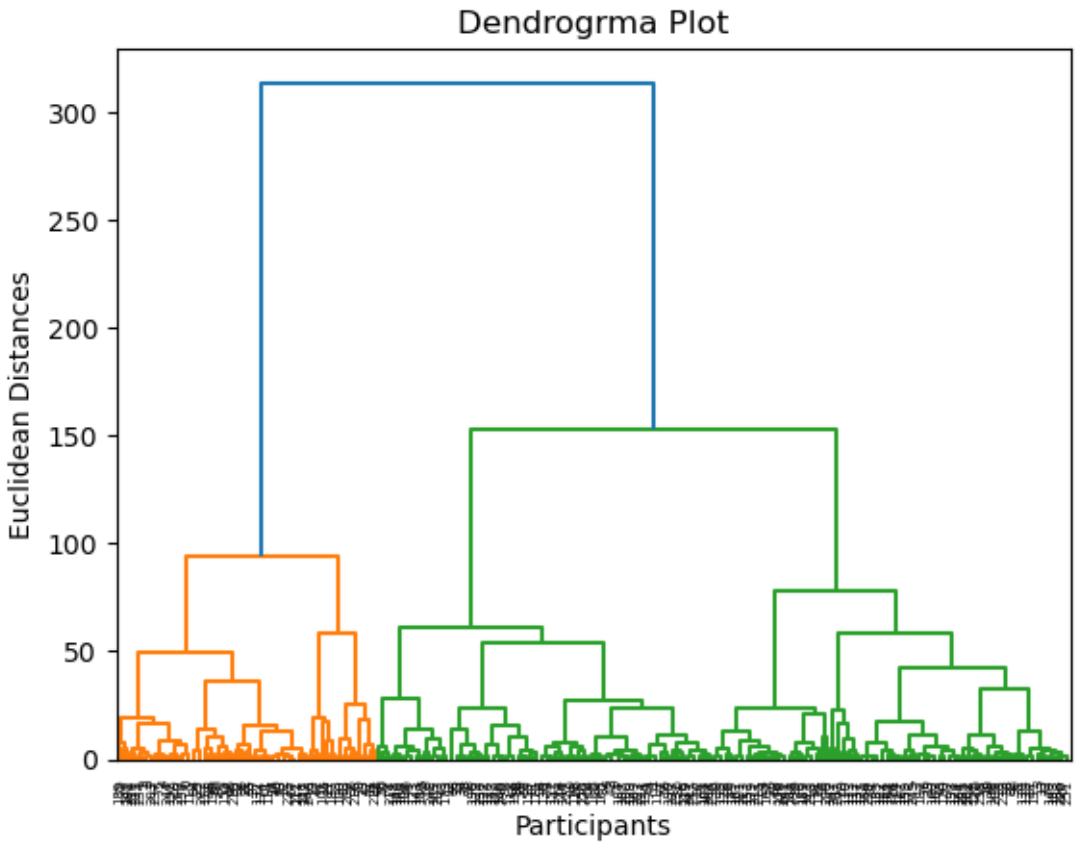
[14]:

	wb1	wb2	wb3	wb4	wb5	wb6	wb7	wb8	wb9	wb10	…	\
0	2.0	2.0	3.0	3.0	3.0	2.0	3.0	4.0	2.0	3.0	…	
1	4.0	5.0	4.0	5.0	4.0	3.0	4.0	4.0	4.0	3.0	…	

```
2  3.0  3.0  3.0  3.0  3.0  3.0  3.0  3.0  3.0   3.0  …

   Behavioral_disengagement  Venting  Positive_reframing  Planning  Humor  \
0                       2.0      4.0                 4.0       4.0    4.0
1                       3.0      5.0                 3.0       1.0    3.0
2                       3.0      2.0                 3.0       3.0    1.0

   Acceptance  Religion  Self_blame   res  well
0         4.0       3.0         4.0  62.0  42.0
1         4.0       4.0         3.0  80.0  56.0
2         4.0       2.0         2.0  68.0  44.0

[3 rows x 74 columns]
```

[15]:
```
x = df.loc[:, ['res','well']].values
```

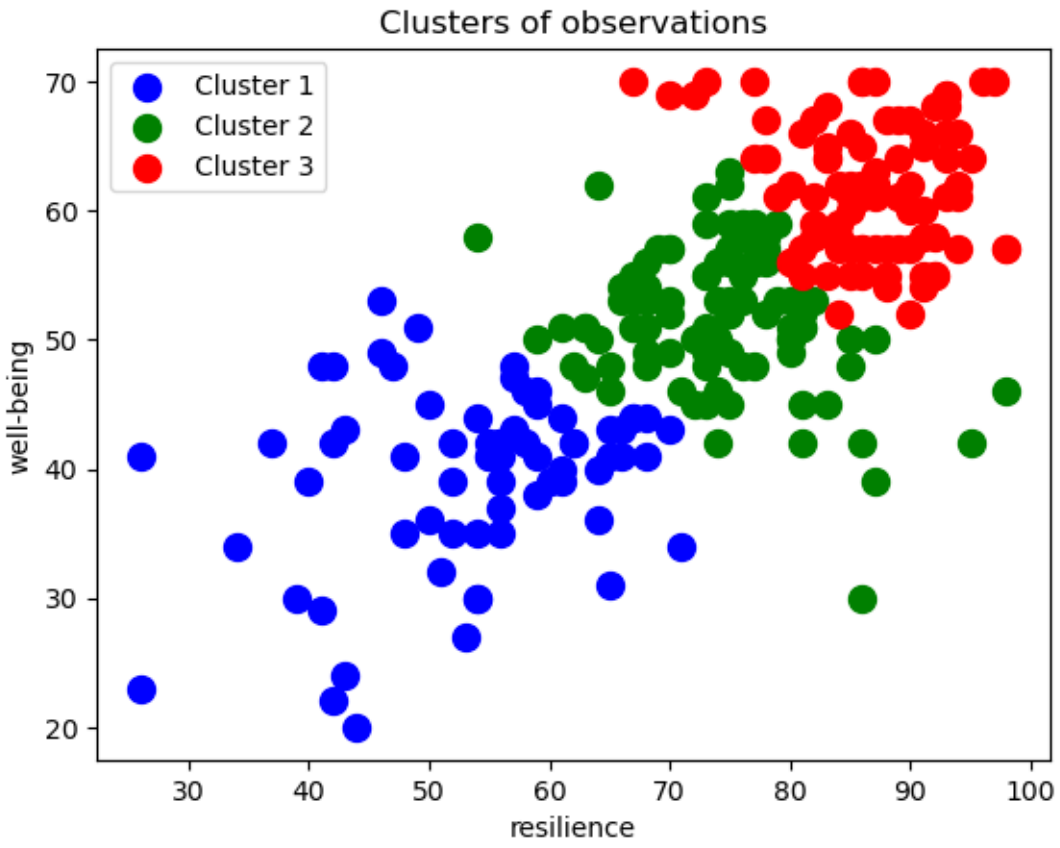
[17]:
```
#Finding the optimal number of clusters using the dendrogram

dendro = shc.dendrogram(shc.linkage(x, method="ward"))
plt.title("Dendrogrma Plot")
plt.ylabel("Euclidean Distances")
plt.xlabel("Participants")
plt.show()
```



It is observed that choosing three clusters is suitable for clustering the paticipants.

[21]:
```
#training the hierarchical model on dataset

hc= AgglomerativeClustering(n_clusters=3, affinity='euclidean', linkage='ward')
y_pred= hc.fit_predict(x)
```

[22]:
```
#visulaizing the clusters
plt.scatter(x[y_pred == 0, 0], x[y_pred == 0, 1], s = 100, c = 'blue', label =␣
 ↪'Cluster 1')
plt.scatter(x[y_pred == 1, 0], x[y_pred == 1, 1], s = 100, c = 'green', label =␣
 ↪'Cluster 2')
plt.scatter(x[y_pred== 2, 0], x[y_pred == 2, 1], s = 100, c = 'red', label =␣
 ↪'Cluster 3')

plt.title('Clusters of observations')
plt.xlabel('resilience')
plt.ylabel('well-being')
plt.legend()
plt.show()
```



[23]:
```
df["label"] = y_pred
avg_df = df.groupby(['label'], as_index=False).mean()
avg_df
```

[23]:

	label	wb1	wb2	wb3	wb4	wb5	wb6	\
0	0	2.594203	2.594203	2.579710	3.333333	3.086957	2.391304	
1	1	3.505263	3.473684	3.263158	4.094737	3.936842	3.178947	
2	2	4.382022	4.213483	4.022472	4.696629	4.539326	4.269663	

	wb7	wb8	wb9	…	Behavioral_disengagement	Venting	\
0	2.608696	2.768116	2.826087	…	2.594203	3.202899	
1	3.336842	3.715789	3.694737	…	2.073684	3.515789	
2	4.258427	4.483146	4.415730	…	1.359551	3.494382	

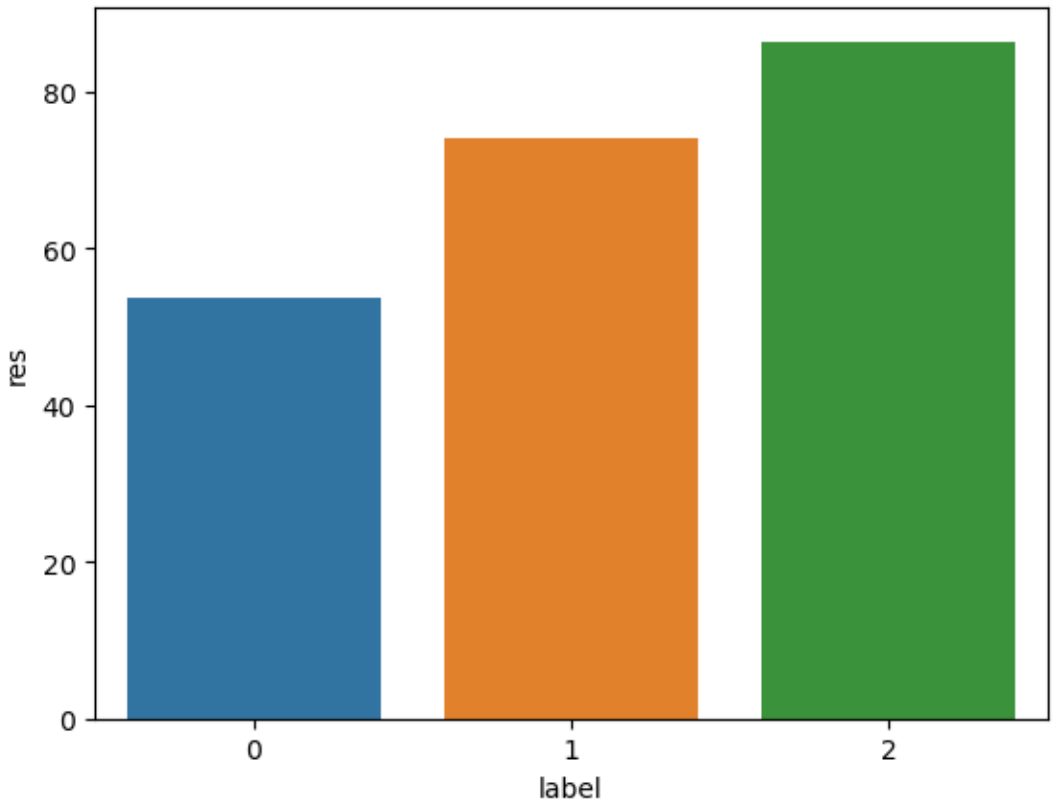
	Positive_reframing	Planning	Humor	Acceptance	Religion	Self_blame	\
0	2.565217	2.840580	2.289855	3.173913	1.782609	3.376812	
1	3.968421	3.947368	2.473684	4.200000	2.073684	2.789474	
2	4.662921	4.786517	2.741573	4.988764	2.348315	2.247191	

	res	well

```
0  53.811594  39.507246
1  74.052632  51.768421
2  86.415730  61.786517

[3 rows x 75 columns]
```

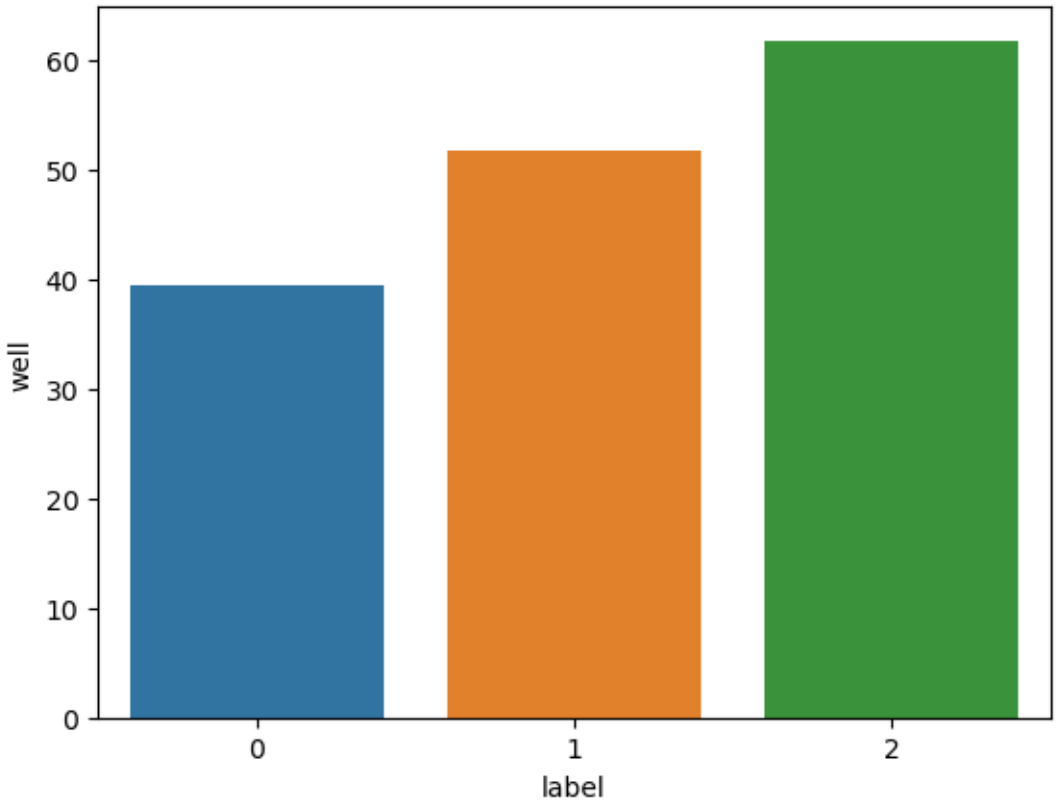
[24]:
```
# visualizing the mean of resilience in each cluster
sns.barplot(x='label',y='res', data=avg_df)
```

[24]:
```
<Axes: xlabel='label', ylabel='res'>
```



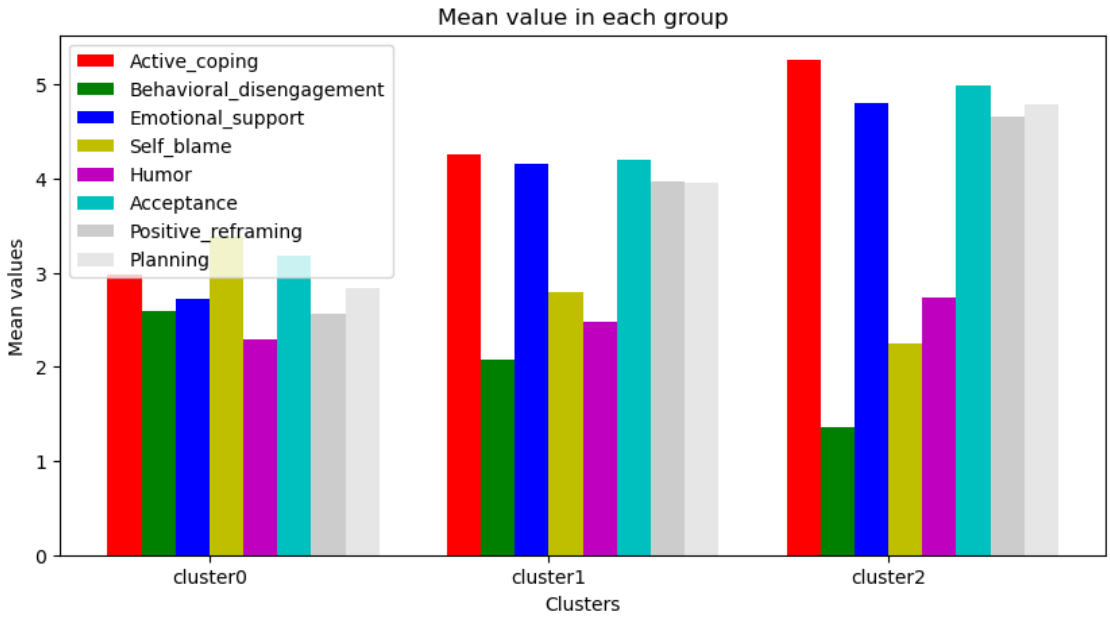
[25]:
```
sns.barplot(x='label',y='well', data=avg_df)
```

[25]:
```
<Axes: xlabel='label', ylabel='well'>
```



[26]:
```
# visualizing the mean of features in each cluster

N = 3
ind = np.arange(3)
width = 0.25
plt.figure(figsize=(10,5))
xvals = avg_df["Active_coping"]
bar1 = plt.bar(ind, xvals, width=0.1, color = 'r')

yvals = avg_df["Behavioral_disengagement"]
bar2 = plt.bar(ind+0.1, yvals, width=0.1, color='g')

zvals = avg_df["Emotional_support"]
bar3 = plt.bar(ind+0.2, zvals, width=0.1, color = 'b')

wvals = avg_df["Self_blame"]
bar4 = plt.bar(ind+0.3, wvals, width=0.1, color = 'y')

tvals = avg_df["Humor"]
bar5 = plt.bar(ind+0.4, tvals, width=0.1, color = 'm')
```

```
svals = avg_df["Acceptance"]
bar6 = plt.bar(ind+0.5, svals, width=0.1, color = 'c')

bvals = avg_df["Positive_reframing"]
bar7 = plt.bar(ind+0.6, bvals, width=0.1, color = '0.8')

dvals = avg_df["Planning"]
bar8 = plt.bar(ind+0.7, dvals, width=0.1, color = '0.9')

plt.xlabel("Clusters")
plt.ylabel('Mean values')
plt.title("Mean value in each group")

plt.xticks(ind+width,['cluster0', 'cluster1', 'cluster2'])
plt.legend( (bar1, bar2, bar3, bar4, bar5, bar6, bar7,bar8), ('Active_coping',␣
 ↪'Behavioral_disengagement',

 ↪'Emotional_support','Self_blame','Humor','Acceptance','Positive_reframing','Planning')␣
 ↪)
plt.show()
```



0.0.1 Main attributes of each cluster

Cluster 2: This cluster includes juveniles with the most resilience and well-being. They had high average for **Active_coping, Emotional_support, Acceptance, planning** and **Positive_reframing** and low average in *Behavioral_disengagement*, *Self_blame* and *Humor*.

Cluster 1: juveniles with the moderate resilience and well-being. This group had moderate average in almost all features and high average for *Active_coping*, *Emotional_support* and *Acceptance*.

Cluster 2: This group had the lowest value of resilience and well-being characteristic. Active_coping, Emotional_support, Acceptance, planning and Positive_reframing were minimum for these juveniles.

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