Data Science amb Python

Sprint 9 : Correlation, Feature Scaling & Feature Engineering

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Exercise 1

Grab a sports-themed dataset that you like and normalize categorical attributes in dummy. Normalize numeric attributes with StandardScaler.

In [1]:
```
#import libraries

import numpy as np, pandas as pd, matplotlib.pylab as plt, seaborn as sns
```

In [2]:
```
df_sport = pd.read_csv('athlete_olympics.csv')
df_sport.head()
```

Out[2]:

	ID	Sex	Age	Height	Weight	NOC	Season	Medal
0	1	M	24.0	180.0	80.0	CHN	Summer	NaN
1	2	M	23.0	170.0	60.0	CHN	Summer	NaN
2	3	M	24.0	NaN	NaN	DEN	Summer	NaN
3	4	M	34.0	NaN	NaN	DEN	Summer	Gold
4	5	F	21.0	185.0	82.0	NED	Winter	NaN

In [3]:
```
df_sport.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 271116 entries, 0 to 271115
Data columns (total 8 columns):
 #   Column  Non-Null Count   Dtype  
---  ------  --------------   -----  
 0   ID      271116 non-null  int64  
 1   Sex     271116 non-null  object 
 2   Age     261642 non-null  float64
 3   Height  210945 non-null  float64
 4   Weight  208241 non-null  float64
 5   NOC     271116 non-null  object 
 6   Season  271116 non-null  object 
 7   Medal   39783 non-null   object 
dtypes: float64(3), int64(1), object(4)
memory usage: 16.5+ MB
```

In [4]:
```
# Evaluating for Missing Data
missing_data = df_sport.isnull()
missing_data.head(5)
```

Out[4]:

	ID	Sex	Age	Height	Weight	NOC	Season	Medal
0	False	False	False	False	False	False	False	True
1	False	False	False	False	False	False	False	True
2	False	False	False	True	True	False	False	True
3	False	False	False	True	True	False	False	False
4	False	False	False	False	False	False	False	True

In [5]:
```
#counting for missing data
for column in missing_data.columns.values.tolist():
    print(column)
    print (missing_data[column].value_counts())
    print("")
```

```
ID
False    271116
Name: ID, dtype: int64

Sex
False    271116
Name: Sex, dtype: int64

Age
False    261642
True       9474
Name: Age, dtype: int64

Height
False    210945
True      60171
Name: Height, dtype: int64

Weight
False    208241
True      62875
Name: Weight, dtype: int64

NOC
False    271116
Name: NOC, dtype: int64

Season
False    271116
Name: Season, dtype: int64

Medal
True     231333
False     39783
Name: Medal, dtype: int64
```

Deal with missing data

- The missing data in 'Age', 'Height', and 'Weight' columns will be replaced by their mean.
- The missing data in 'Medal' column will be replaced number 0.

In [6]:
```
# Replace the Age, Height and Weight NaN by their median.

df_sport['Age'].fillna(df_sport['Age'].median(), inplace=True)

df_sport['Height'].fillna(df_sport['Height'].median(), inplace=True)

df_sport['Weight'].fillna(df_sport['Weight'].median(), inplace=True)
```

In [7]:
```
#Replace 'NaN' in Medal column with N0_Medal

df_sport['Medal'] = df_sport['Medal'].fillna('No_Medal')

df_sport.head()
```

Out[7]:

	ID	Sex	Age	Height	Weight	NOC	Season	Medal
0	1	M	24.0	180.0	80.0	CHN	Summer	No_Medal
1	2	M	23.0	170.0	60.0	CHN	Summer	No_Medal
2	3	M	24.0	175.0	70.0	DEN	Summer	No_Medal
3	4	M	34.0	175.0	70.0	DEN	Summer	Gold
4	5	F	21.0	185.0	82.0	NED	Winter	No_Medal

In [8]:
```
print('Unique values of Sex are: ', df_sport['Sex'].nunique(), '\n')
print('Unique values of Season are: ', df_sport['Season'].nunique(), '\n')
print('Unique values of NOC are: ', df_sport['NOC'].nunique(), '\n')
print('Unique values of Medal are: ', df_sport['Medal'].nunique())
```

```
Unique values of Sex are:  2

Unique values of Season are:  2

Unique values of NOC are:  230

Unique values of Medal are:  4
```

Normalize categorical attributes in dummy.

The column "Sex" has two unique values (M or F), as well Season (Summer or Winter). There are many unique values in NOC and the Medal column has four inique values I convert "Sex", "Season" and "Medal" into indicator variables.

In [9]:
```
dummy_variable_1 = pd.get_dummies(df_sport["Sex"])
dummy_variable_1.head()
```

Out[9]:

	F	M
0	0	1
1	0	1
2	0	1
3	0	1
4	1	0

In [10]:
```
dummy_variable_2 = pd.get_dummies(df_sport["Season"])
dummy_variable_2.head()
```

Out[10]:

	Summer	Winter
0	1	0
1	1	0
2	1	0
3	1	0
4	0	1

In [11]:
```
dummy_variable_3 = pd.get_dummies(df_sport["Medal"])
dummy_variable_3.head()
```

Out[11]:

	Bronze	Gold	No_Medal	Silver
0	0	0	1	0
1	0	0	1	0
2	0	0	1	0
3	0	1	0	0
4	0	0	1	0

In [12]:
```
# merge data frame "df" and "dummy_variable_1"

df_dummy = df_sport.copy()
df_dummy = pd.concat([df_dummy, dummy_variable_1, dummy_variable_2, dummy_
```

In [13]:
```
# Set ID column as index

df_dummy.set_index('ID', inplace=True)
```

In [14]:
```
# drop original columns "Sex", "Season", and "Medal" from "df_dummy"
df_dummy.drop(["Sex", "Season", "Medal", "NOC"], axis = 1, inplace=True)
```

In [15]:
```
df_dummy.head()
```

Out[15]:

ID	Age	Height	Weight	F	M	Summer	Winter	Bronze	Gold	No_Medal	Silver
1	24.0	180.0	80.0	0	1	1	0	0	0	1	0
2	23.0	170.0	60.0	0	1	1	0	0	0	1	0
3	24.0	175.0	70.0	0	1	1	0	0	0	1	0
4	34.0	175.0	70.0	0	1	1	0	0	1	0	0
5	21.0	185.0	82.0	1	0	0	1	0	0	1	0

In [ ]:

```
```

Normalize numeric attributes with StandardScaler.

In [16]:

```
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()

print(scaler.fit(df_dummy))
```

```
StandardScaler()
```

In [18]:

```
print(scaler.mean_)
```

```
[2.55024934e+01 1.75263740e+02 7.05394997e+01 2.74871273e-01
 7.25128727e-01 8.20873722e-01 1.79126278e-01 4.90380501e-02
 4.93220614e-02 8.53262072e-01 4.83778161e-02]
```

Exercise 2

Continue with the sports theme dataset you like and apply the Principal Component Analysis (PCA).

In [19]:

```
from sklearn.decomposition import PCA
df_dummy.shape
```

Out[19]:

```
(271116, 11)
```

In [21]:

```
pca = PCA(n_components=11)
principal_components = pca.fit_transform(df_dummy)
principal_df = pd.DataFrame(data = principal_components, columns = ['pc_1'
                                                                     'pc_4'
                                                                     'pc_8'


principal_df
```

Out[21]:

	pc_1	pc_2	pc_3	pc_4	pc_5	pc_6	pc_7	
0	10.347542	-2.087541	1.690286	-0.320550	0.101085	-0.187643	-0.000670	0.0
1	-11.820328	-1.797025	-1.360767	-0.683409	-0.128362	-0.098957	0.002051	0.0
2	-0.698556	-1.447969	0.100028	-0.496547	-0.012337	-0.144164	0.000688	0.0
3	0.060867	8.439004	-1.195831	-0.335009	0.141092	0.987906	0.757249	-0.2
4	14.543699	-5.795786	-0.841925	1.685174	-0.350136	-0.238126	-0.004092	-0.0
...	...	...	...	...	...	...	...	
271111	17.582007	3.099978	6.960963	0.542258	-1.004817	-0.119234	-0.001040	-0.0
271112	-8.976967	1.244770	-7.319863	0.178222	-1.313067	-0.021342	0.000400	-0.
271113	-8.976967	1.244770	-7.319863	0.178222	-1.313067	-0.021342	0.000400	-0.
271114	26.792172	3.266600	5.909477	0.715006	-0.915064	-0.158897	-0.002546	-0.0
271115	27.094865	7.221111	5.391623	0.758473	-0.904650	-0.165809	-0.002565	-0.0

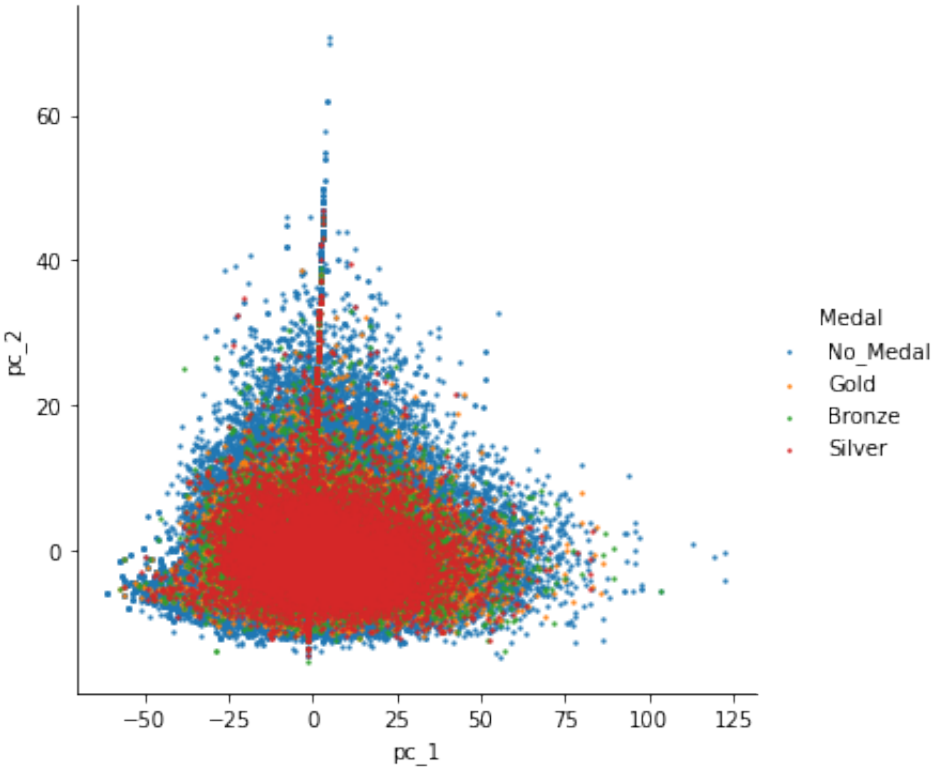
271116 rows × 11 columns

In [24]:
```
final_df = pd.concat([principal_df, df_sport[['Medal']]], axis=1)
final_df.head()
```

Out[24]:

	pc_1	pc_2	pc_3	pc_4	pc_5	pc_6	pc_7	pc_8
0	10.347542	-2.087541	1.690286	-0.320550	0.101085	-0.187643	-0.000670	0.000408
1	-11.820328	-1.797025	-1.360767	-0.683409	-0.128362	-0.098957	0.002051	0.000067
2	-0.698556	-1.447969	0.100028	-0.496547	-0.012337	-0.144164	0.000688	0.000180
3	0.060867	8.439004	-1.195831	-0.335009	0.141092	0.987906	0.757249	-0.296775
4	14.543699	-5.795786	-0.841925	1.685174	-0.350136	-0.238126	-0.004092	-0.000425

In [30]:
```
# Plot
sns.lmplot( x="pc_1", y="pc_2",
  data=final_df,
  fit_reg=False,
  hue='Medal', # color by cluster
  legend=True,
  scatter_kws={"s": 2}); # specify the point size
```



There is no clearly separation between the medals.

In [ ]:
```
```

Exercise 3

Continue with the sports theme data set you like and normalize the data taking into account the outliers.

In [31]:
```
df_dummy.headd
```

Out[31]:

ID	Age	Height	Weight	F	M	Summer	Winter	Bronze	Gold	No_Medal	Silver
1	24.0	180.0	80.0	0	1	1	0	0	0	1	0
2	23.0	170.0	60.0	0	1	1	0	0	0	1	0
3	24.0	175.0	70.0	0	1	1	0	0	0	1	0
4	34.0	175.0	70.0	0	1	1	0	0	1	0	0
5	21.0	185.0	82.0	1	0	0	1	0	0	1	0

In [32]:
```
from sklearn.preprocessing import RobustScaler
transformer = RobustScaler().fit(df_dummy)
```

In [33]:
```
transformer
```

Out[33]:
```
RobustScaler()
```

In [34]:
```
transformer.transform(df_dummy)
```

Out[34]:
```
array([[ 0.        ,  0.5       ,  0.83333333, ...,  0.        ,
         0.        ,  0.        ],
       [-0.16666667, -0.5       , -0.83333333, ...,  0.        ,
         0.        ,  0.        ],
       [ 0.        ,  0.        ,  0.        , ...,  0.        ,
         0.        ,  0.        ],
       ...,
       [ 0.5       ,  0.1       , -0.91666667, ...,  0.        ,
         0.        ,  0.        ],
       [ 1.        ,  1.        ,  2.16666667, ...,  0.        ,
         0.        ,  0.        ],
       [ 1.66666667,  1.        ,  2.16666667, ...,  0.        ,
         0.        ,  0.        ]])
```

In [ ]: