DAT405 Assignment 1 – Group 85

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[1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
```

[2]:
```
GDP_per_capita = pd.read_csv("./life-expectancy.csv")
life_expect = pd.read_csv("./maddison-data-gdp-per-capita-in-2011us.csv")
GDP = pd.read_csv("./gdp-in-british-pounds.csv")
```

[3]:
```
d = GDP_per_capita.merge(life_expect, on=('Year', 'Entity'))
d = d.merge(GDP, on=('Year', 'Entity'))
reduced_d = d[d.Year == 2000]
reduced_d.rename(columns={'GDP (Fouquin and Hugot (CEPII 2016))': 'GDP'},␣
↪inplace = True)
reduced_d
```

[3]:
```
         Entity Code_x  Year  Life expectancy at birth (historical) Code_y  \
98      Albania    ALB  2000                                   75.4    ALB
163     Algeria    DZA  2000                                   70.5    DZA
203      Angola    AGO  2000                                   46.0    AGO
281   Argentina    ARG  2000                                   73.9    ARG
306     Armenia    ARM  2000                                   70.6    ARM
...         ...    ...   ...                                    ...    ...
9882  Venezuela    VEN  2000                                   72.5    VEN
9942    Vietnam    VNM  2000                                   72.5    VNM
9967      Yemen    YEM  2000                                   62.6    YEM
10031    Zambia    ZMB  2000                                   45.2    ZMB
10095  Zimbabwe    ZWE  2000                                   44.7    ZWE

   GDP per capita 417485-annotations Code           GDP
98      4808.4795                NaN  ALB  2.400530e+09
163     6834.5537                NaN  DZA  3.621245e+10
203     2013.6362                NaN  AGO  6.034059e+09
```

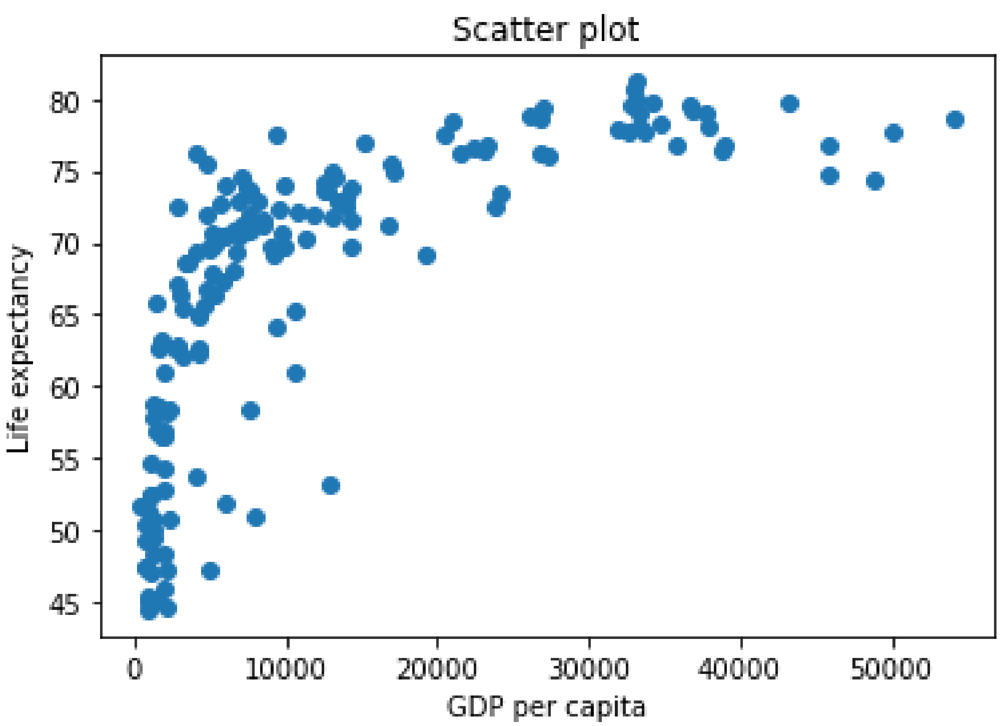
```
281         14368.9420                NaN  ARG  1.878391e+11
306          5139.8257                NaN  ARM  1.263412e+09
...                ...                ...  ...           ...
9882        13992.6080                NaN  VEN  7.742649e+10
9942         2773.1016                NaN  VNM  2.223377e+10
9967         4212.1055                NaN  YEM  6.368957e+09
10031        1428.5024                NaN  ZMB  2.379803e+09
10095        2211.1963                NaN  ZWE  4.421600e+09

[158 rows x 9 columns]
```

a) Write a Python program that draws a scatter plot of GDP per capita vs life expectancy. State any assumptions and motivate decisions that you make when selecting data to be plotted, and in combining data.

[4]:
```python
x,y = reduced_d['GDP per capita'], reduced_d['Life expectancy at birth␣
 ↪(historical)']
plt.scatter(x,y)
plt.xlabel('GDP per capita')
plt.ylabel('Life expectancy')
plt.title('Scatter plot')
```

[4]: `Text(0.5, 1.0, 'Scatter plot')`



b) Which countries have a life expectancy higher than one standard deviation above the mean?

[5]:
```
std_exp = np.std(a=reduced_d['Life expectancy at birth (historical)'])
mean_exp = np.mean(a=reduced_d['Life expectancy at birth (historical)'])
mean_std_exp = mean_exp + std_exp
```

[6]:
```
return_list = []
for i, r in reduced_d.iterrows():
country = r["Entity"]
life_exp = r['Life expectancy at birth (historical)']
if life_exp > mean_std_exp:
    return_list.append(country)
return_list
```

[6]:
```
['Australia',
'Austria',
'Belgium',
'Canada',
'Costa Rica',
'Finland',
'France',
'Germany',
'Greece',
'Hong Kong',
'Iceland',
'Israel',
'Italy',
'Japan',
'Luxembourg',
'Malta',
'Netherlands',
'New Zealand',
'Norway',
'Singapore',
'Spain',
'Sweden',
'Switzerland',
'United Kingdom']
```

c) Which countries have high life expectancy but have low GDP? Motivate how you have chosen to define "high" and "low".

[7]:
```
std_gdp = np.std(a=reduced_d['GDP'])
mean_gdp = np.mean(a=reduced_d['GDP'])

std_exp = np.std(a=reduced_d['Life expectancy at birth (historical)'])
mean_exp = np.mean(a=reduced_d['Life expectancy at birth (historical)'])

mean_std_exp = mean_exp + std_exp
mean_std_gdp = mean_gdp - std_gdp
```

[8]:
```
return_list = []
for i, r in reduced_d.iterrows():
country = r["Entity"]
life_exp = r['Life expectancy at birth (historical)']
gdp = r['GDP']
if life_exp > mean_std_exp and gdp < mean_std_gdp:
    return_list.append(country)
return_list
```

[8]:
```
[]
```

Answer: No countries fit our criteria. For life expectancy we have decided to define “high” as 1 standard deviation above the mean. For GDP we have decided to define “low” as 1 standard deviation below the mean.

d) Does every strong economy (normally indicated by GDP) have high life expectancy?

[9]:
```
std_gdp = np.std(a=reduced_d['GDP'])
mean_gdp = np.mean(a=reduced_d['GDP'])

std_exp = np.std(a=reduced_d['Life expectancy at birth (historical)'])
mean_exp = np.mean(a=reduced_d['Life expectancy at birth (historical)'])

mean_std_gdp = mean_gdp + std_gdp
mean_std_exp = mean_exp + std_exp
```

[10]:
```
return_list_high = []
return_list_low = []
for i, r in reduced_d.iterrows():
country = r["Entity"]
life_exp = r['Life expectancy at birth (historical)']
gdp = r['GDP']
if gdp > mean_std_gdp:
    if life_exp > mean_std_exp:
        return_list_high.append(country)
```

```python
    else:
        return_list_low.append(country)
```

[11]:
```python
tot_len = len(return_list_low + return_list_high)

percentage = len(return_list_high)/tot_len
print(f'Percentage of countries with high life expectancy and high GDP is␣
 ↪{round(percentage*100, 2)}%')
```

```
Percentage of countries with high life expectancy and high GDP is 71.43%
```

Answer: Yes, mostly. 71,43% of the countries with high GDP have high life expectancy, indicating a weak correlation.

e) Related to question d, what would happen if you use GDP per capita as an indicator of strong economy? Explain the results you obtained, and discuss any insights you get from comparing the results of d and e.

[12]:
```python
std_gdp = np.std(a=reduced_d['GDP per capita'])
mean_gdp = np.mean(a=reduced_d['GDP per capita'])

std_exp = np.std(a=reduced_d['Life expectancy at birth (historical)'])
mean_exp = np.mean(a=reduced_d['Life expectancy at birth (historical)'])

mean_std_gdp = mean_gdp + std_gdp
mean_std_exp = mean_exp + std_exp
```

[13]:
```python
return_list_high = []
return_list_low = []
for i, r in reduced_d.iterrows():
country = r["Entity"]
life_exp = r['Life expectancy at birth (historical)']
gdp = r['GDP per capita']
if gdp > mean_std_gdp:
    if life_exp > mean_std_exp:
        return_list_high.append(country)
    else:
        return_list_low.append(country)
```

[14]:
```python
tot_len = len(return_list_low + return_list_high)

percentage = len(return_list_high)/tot_len
print(f'Percentage of countries with high life expectancy and high GDP per␣
 ↪capita is {round(percentage*100, 2)}%')
```

```
Percentage of countries with high life expectancy and high GDP per capita is
```

72.41%

Answer: From our results GDP per capita and GDP are decent indicators of strong economies. A factor that GDP per capita/GDP doesn't concider, is where the money is coming from, if it's one indusry (eg oil) or multiple intustries. Having multiple strong industries are much prefered as it reduces the risk of an economic collapse.

We tested with diffrent years and found that the percentage varies a lot. From the 1900s the percentage has stedily decreased, indicating weaker coorelation between strong economies and and life expectancy. This might be because either poor countries economies grow faster than their life expectancy, or that their life expectancy grow faster than the economy.

We used the same deviation every time (1 standart deviation), so that we could compare results between questions.

We choose to reduce our dataset to one year to simplify the calculations. The year 2000 was chosen because it is recent and we had data for that year.

References

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reduced_d = d[d.Year == 2000]
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    inplace = True)
reduced_d

x,y = reduced_d['GDP per capita'], reduced_d['Life expectancy at birth (
    historical)']
plt.scatter(x,y)
plt.xlabel('GDP per capita')
plt.ylabel('Life expectancy')
plt.title('Scatter plot')

std_exp = np.std(a=reduced_d['Life expectancy at birth (historical)'])
mean_exp = np.mean(a=reduced_d['Life expectancy at birth (historical)'])
mean_std_exp = mean_exp + std_exp

return_list = []
for i, r in reduced_d.iterrows():
    country = r["Entity"]
    life_exp = r['Life expectancy at birth (historical)']
    if life_exp > mean_std_exp:
        return_list.append(country)
```

```
return_list

std_gdp = np.std(a=reduced_d['GDP'])
mean_gdp = np.mean(a=reduced_d['GDP'])

std_exp = np.std(a=reduced_d['Life expectancy at birth (historical)'])
mean_exp = np.mean(a=reduced_d['Life expectancy at birth (historical)'])

mean_std_exp = mean_exp + std_exp
mean_std_gdp = mean_gdp - std_gdp

return_list = []
for i, r in reduced_d.iterrows():
    country = r["Entity"]
    life_exp = r['Life expectancy at birth (historical)']
    gdp = r['GDP']
    if life_exp > mean_std_exp and gdp < mean_std_gdp:
        return_list.append(country)
return_list

std_gdp = np.std(a=reduced_d['GDP'])
mean_gdp = np.mean(a=reduced_d['GDP'])

std_exp = np.std(a=reduced_d['Life expectancy at birth (historical)'])
mean_exp = np.mean(a=reduced_d['Life expectancy at birth (historical)'])

mean_std_gdp = mean_gdp + std_gdp
mean_std_exp = mean_exp + std_exp

return_list_high = []
return_list_low = []
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    gdp = r['GDP']
    if gdp > mean_std_gdp:
        if life_exp > mean_std_exp:
            return_list_high.append(country)
        else:
            return_list_low.append(country)

tot_len = len(return_list_low + return_list_high)

percentage = len(return_list_high)/tot_len
print(f'Percentage of countries with high life expectancy and high GDP is {
    round(percentage*100, 2)}%')

std_gdp = np.std(a=reduced_d['GDP per capita'])
mean_gdp = np.mean(a=reduced_d['GDP per capita'])

std_exp = np.std(a=reduced_d['Life expectancy at birth (historical)'])
mean_exp = np.mean(a=reduced_d['Life expectancy at birth (historical)'])

mean_std_gdp = mean_gdp + std_gdp
mean_std_exp = mean_exp + std_exp
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```
return_list_high = []
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for i, r in reduced_d.iterrows():
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    life_exp = r['Life expectancy at birth (historical)']
    gdp = r['GDP per capita']
    if gdp > mean_std_gdp:
        if life_exp > mean_std_exp:
            return_list_high.append(country)
        else:
            return_list_low.append(country)

tot_len = len(return_list_low + return_list_high)

percentage = len(return_list_high)/tot_len
print(f'Percentage of countries with high life expectancy and high GDP per
    capita is {round(percentage*100, 2)}%')
```