

Big Data and Automated Content Analysis

Week 6 – Wednesday

»Statistics with Python«

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Today

① Statistics in Python

General considerations

Useful packages

② Pandas

Working with dataframes

Plotting and calculating with Pandas

③ Exercise

Statistics in Python

General considerations

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After having done all your nice text processing (and got numbers instead of text!), you probably want to analyse this further. You can always export to .csv and use R or Stata or SPSS or whatever. . .

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BUT:

Reasons for not exporting and analyzing somewhere else

- the dataset might be too big
- it's cumbersome and wastes your time
- it may introduce errors and makes it harder to reproduce

What statistics capabilities does Python have?

- Basically all standard stuff (bivariate and multivariate statistics) you know from SPSS
- Some advanced stuff (e.g., time series analysis)
- However, for some fancy statistical modelling (e.g., structural equation modelling), you can better look somewhere else (R)

Statistics in Python

Useful packages

Useful packages

numpy (numerical python) Provides a lot of frequently used functions, like mean, standard deviation, correlation,

...

scipy (scientific python) More of that ;-)

statsmodels Statistical models (e.g., regression or time series)

matplotlib Plotting

seaborn Even nicer plotting

Example 1: basic numpy

```
1 import numpy as np
2 x = [1,2,3,4,3,2]
3 y = [2,2,4,3,4,2]
4 z = [9.7, 10.2, 1.2, 3.3, 2.2, 55.6]
5 np.mean(x)
```

```
1 2.5
```

```
1 np.std(x)
```

```
1 0.9574271077563381
```

```
1 np.corrcoef([x,y,z])
```

```
1 array([[ 1.          ,  0.67883359, -0.37256219],
2        [ 0.67883359,  1.          , -0.56886529],
3        [-0.37256219, -0.56886529,  1.          ]])
```

Characteristics

- Operates (also) on simple lists
- Returns output in standard datatypes (you can print it, store it, calculate with it, ...)
- it's fast! `np.mean(x)` is faster than `sum(x)/len(x)`
- it is more accurate (less rounding errors)

Example 2: basic plotting

```
1 import matplotlib.pyplot as plt
2 x = [1,2,3,4,3,2]
3 y = [2,2,4,3,4,2]
4 plt.hist(x)
5 plt.plot(x,y)
6 plt.scatter(x,y)
```

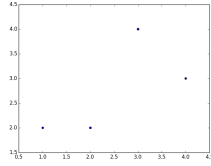
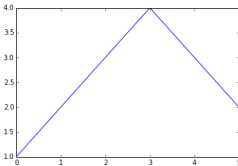
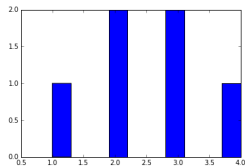


Figure: Examples of plots generated with matplotlib

Pandas

Working with dataframes

When to use dataframes

Native Python data structures (lists, dicts, generators)

pro:

- flexible (especially dicts!)
- fast
- straightforward and easy to understand

con:

- if your data is a table, modeling this as, e.g., lists of lists feels unintuitive
- very low-level: you need to do much stuff 'by hand'

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Pandas dataframes

pro:

- like an R dataframe or a STATA or SPSS dataset
- many convenience functions (descriptive statistics, plotting over time, grouping and subsetting, ...)

con:

- not always necessary ('overkill')
- if you deal with really large datasets, you don't want to load them fully into memory (which pandas does)

Pandas

Plotting and calculating with Pandas

More examples here: https://github.com/damian0604/bdaca/blob/master/ipy nb/basic_statistics.ipynb

OLS regression in pandas

```
1 import pandas as pd
2 import statsmodels.formula.api as smf
3
4 df = pd.DataFrame({'income': [10,20,30,40,50], 'age': [20, 30, 10, 40,
50], 'facebooklikes': [32, 234, 23, 23, 42523]})
5
6 # alternative: read from CSV file (or stata...):
7 # df = pd.read_csv('mydata.csv')
8
9 myfittedregression = smf.ols(formula='income ~ age + facebooklikes',
10                               data=df).fit()
11 print(myfittedregression.summary())
```

```

1 OLS Regression Results
2 =====
3 Dep. Variable:          income  R-squared:                0.579
4 Model:                  OLS     Adj. R-squared:             0.158
5 Method:                  Least Squares  F-statistic:             1.375
6 Date:                   Mon, 05 Mar 2018  Prob (F-statistic):    0.421
7 Time:                   18:07:29  Log-Likelihood:          -18.178
8 No. Observations:        5       AIC:                     42.36
9 Df Residuals:            2       BIC:                     41.19
10 Df Model:                2
11 Covariance Type:        nonrobust
12 =====
13 coef    std err          t      P>|t|      [95.0% Conf. Int.]
14 -----
15 Intercept              14.9525    17.764     0.842    0.489    -61.481    91.386
16 age                   0.4012     0.650     0.617    0.600    -2.394     3.197
17 facebooklikes         0.0004     0.001     0.650    0.583    -0.002     0.003
18 =====
19 Omnibus:                nan    Durbin-Watson:            1.061
20 Prob(Omnibus):          nan    Jarque-Bera (JB):         0.498
21 Skew:                   -0.123  Prob(JB):                 0.780
22 Kurtosis:               1.474  Cond. No.                  5.21e+04
23 =====

```

Other cool df operations

`df['age'].plot()` to plot a column

`df['age'].describe()` to get descriptive statistics

`df['age'].value_counts()` to get a frequency table

and MUCH more...

Recoding and transforming

To transform your data, you can use `.apply()`, `.applymap()`, and `.map()` or the `.str.XXX()` methods:

```
1 df['is_center'] = df['hood'].str.contains('[cC]enter')
```

or define your own function:

```
1 def is_center(x):  
2     return int(x.lower().find('center') > -1)  
3  
4 df['is_center'] = df['hood'].map(is_center)
```

or use a throwaway-function:

```
1 df['is_center'] = df['hood'].map(lambda x: int(x.lower().find('center')  
    > -1))
```

Joanna will introduce you to the exercise

... and of course you can also ask questions about the last weeks if you still have some!