Programmiersprachen zur Datenanalyse – WHO-Projekt

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Ausgangssituation

- Datensatz der World Health Organization (WHO) zu der Luftverschmutzung in Städten
- Daten für PM10-Werte und PM2.5-Werte
  - PM10: Feinstaub-Belastung (Partikel kleiner als 10 µm)
  - PM2.5: Feinstaub-Belastung (Partikel kleiner als 2,5 µm)
- Grenzwertunterschiede zwischen EU und WHO
  - EU-Grenzwerte
    - PM10: 40 µg/m³
    - PM2.5: 25 µg/m³
  - WHO-Grenzwerte
    - PM10: 20 µg/m³
    - PM2.5: 10 µg/m³

Ursprünglicher Datensatz

	Region	iso3	Country	City/Town	Year	Annual mean, ug/m3	Temporal coverage	note on converted PM10	Annual mean, ug/m3.1	Temporal coverage.1	note on converted PM2.5	Number and type of monitoring stations	Reference for air quality	Database version (year)	status
0	Europe (LMIC)	ALB	Albania	Korce	2015	45	>75%	Measured	30	>75%	Measured	1 Suburban-Background	The European Environmental Agency (EEA) [downl...	2018	NaN
1	Europe (LMIC)	ALB	Albania	Korce	2016	40	>75%	Measured	29	>75%	Measured	1 Suburban-Background	The European Environmental Agency (EEA) [downl...	2018	NaN
2	Europe (LMIC)	ALB	Albania	Tirana	2013	32	NaN	Measured	16	NaN	Measured	1 station, traffic, urban	European Environment Agency, Air quality e-rep...	2016	NaN
3	Europe (LMIC)	ALB	Albania	Vlore	2014	15	>75%	Measured	(10)-converted value	NaN	Converted	1 Urban-Background	The European Environmental Agency (EEA) [downl...	2018	NaN
4	Europe (LMIC)	ALB	Albania	Vlore	2015	19	>75%	Measured	(13)-converted value	NaN	Converted	1 Urban-Background	The European Environmental Agency (EEA) [downl...	2018	NaN

	Region	iso3	Country	City/Town	Year	Annual mean, ug/m3	Temporal coverage	note on converted PM10	Annual mean, ug/m3.1	Temporal coverage.1	note on converted PM2.5	Number and type of monitoring stations	Reference for air quality	Database version (year)	status
0	Europe (LMIC)	ALB	Albania	Korce	2015	45	>75%	Measured	30	>75%	Measured	1 Suburban-Background	The European Environmental Agency (EEA) [downl...	2018	NaN
1	Europe (LMIC)	ALB	Albania	Korce	2016	40	>75%	Measured	29	>75%	Measured	1 Suburban-Background	The European Environmental Agency (EEA) [downl...	2018	NaN
2	Europe (LMIC)	ALB	Albania	Tirana	2013	32	NaN	Measured	16	NaN	Measured	1 station, traffic, urban	European Environment Agency, Air quality e-rep...	2016	NaN

	Region	Country	City	Year	Coverage	Stationcount	Income	Converted	Value
0	Europe	Albania	Korce	2015	>75%	1	LMIC	False	30
1	Europe	Albania	Korce	2016	>75%	1	LMIC	False	29
2	Europe	Albania	Tirana	2013	NaN	1	LMIC	False	16

Print-Ausgaben der Daten

```
compareYears(2013,2016)
```

```
Worldwide statistics for 2016 (WHO limits) compared with 2013
-------------------------------------------------
Limits of WHO:

Limit for PM10 was exceeded in 1468 Cities (-33 Cities)
Limit for PM10 was not exceeded in 1495 Cities(+593 Cities)
Limit for PM25 was exceeded in 2021 Cities (+107 Cities)
Limit for PM25 was not exceeded in 942 (+453 Cities)
-------------------------------------------------
```

Print-Ausgaben der Daten

```
PrintLimitExceedForYear(2016)
```

```
Worldwide statistics for 2016
-------------------------------------------------
Limits of European Union:

Limit for PM10 was exceeded in 544 Cities
Limit for PM10 was not exceeded in 2419 Cities
Limit for PM25 was exceeded in 556 Cities
Limit for PM25 was not exceeded in 2407 Cities
-------------------------------------------------
Limits of WHO:

Limit for PM10 was exceeded in 1468 Cities
Limit for PM10 was not exceeded in 1495 Cities
Limit for PM25 was exceeded in 2021 Cities
Limit for PM25 was not exceeded in 942 Cities
-------------------------------------------------
```

Print-Ausgaben der Daten

```
PrintStatistics('Germany', False)
```

```
############################
# Information for Germany #
############################

Cities:       339
No. of years:   4
First year:  2013
Last year:   2016
```

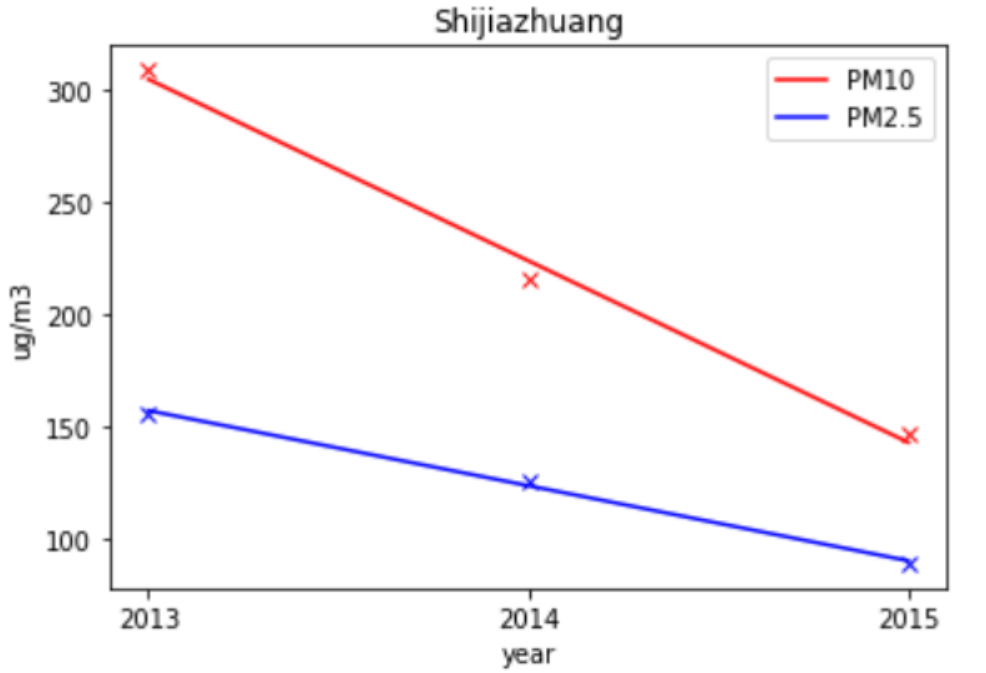
-- PM10 --

	Count	Min		Max		Limit (20ug)
total	1074	7	Bad Hindelang Braunlage	32	Hagen Markgroningen	156/339
2013	267	8	Munstertal/Schw Oberried Oberried-Hofsgr	32	Hagen Markgroningen	104/267
2014	269	7	Bad Hindelang Braunlage	29	Hagen	106/269
2015	265	8	Bad Hindelang	29	Gelsenkirchen Markgroningen	73/265
2016	273	7	Bad Hindelang	26	Gelsenkirchen Hagen Markgroningen Rems-Murr-Kreis	42/273

-- PM2.5 --

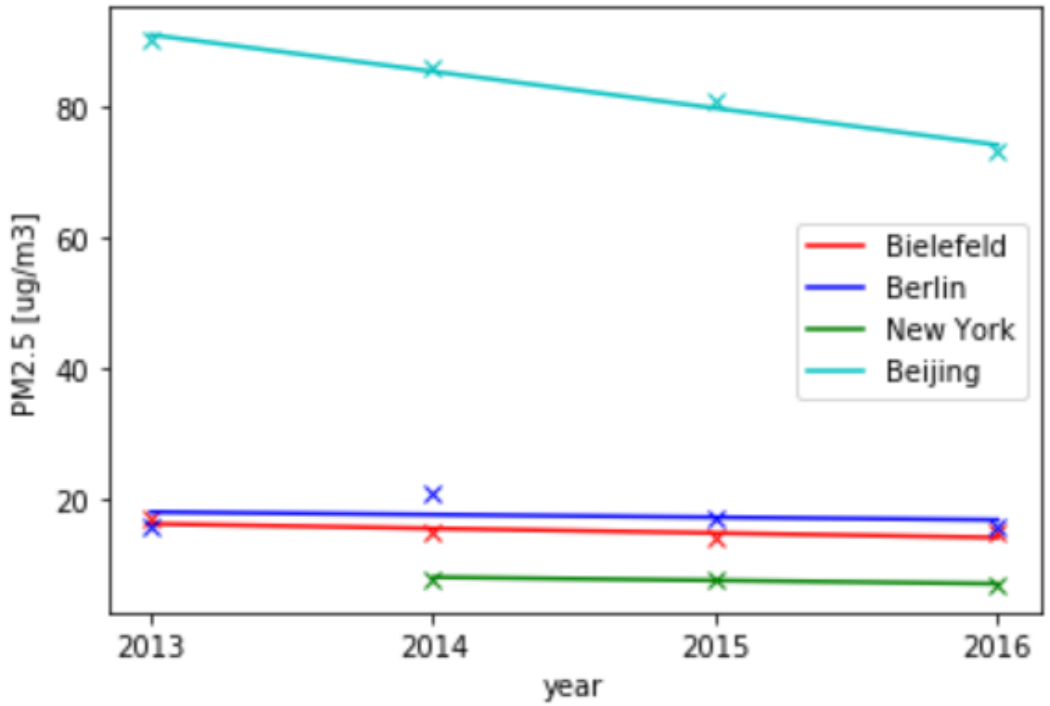
Regression

```
PlotBoth('Shijiazhuang')
```



Regression

```
PlotMultiCities(['Bielefeld', 'Berlin', 'New York', 'Beijing'], ['r', 'b', 'g', 'c'], False)
```



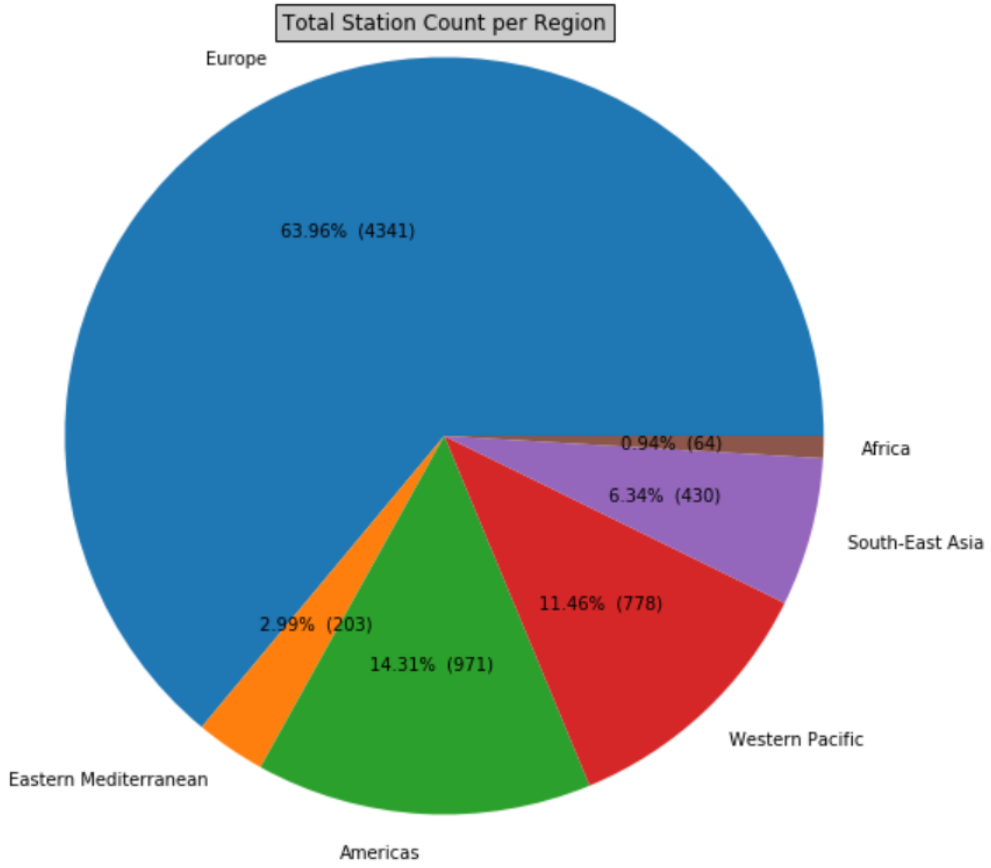
Regression als Liste

```
PrintSlopeRanking(True, False, False)
```

```
 1.  Shijiazhuang (China) -81.00
 2.      Varanasi (India) -47.90
 3.       Xingtai (China) -38.70
 4.       Pakdasht (Iran) -32.43
 5.       Baoding (China) -26.90
 6.      Yangzhou (China) -26.00
 7.      Hengshui (China) -24.00
 8.      Langfang (China) -23.80
 9.    Al-Zarqa' (Jordan) -23.00
10.        Handan (China) -21.00
11.      Zhaoqing (China) -20.40
12. Rajshahi (Bangladesh) -20.00
13.          Ahvaz (Iran) -19.81
14.      Tangshan (China) -19.30
15.        Hohhot (China) -19.29
```

Pie Charts

```
PlotStationCountPerRegion()
```



Pie Charts

```
PlotStationCountByIncome()
```