7.9

March 12, 2018

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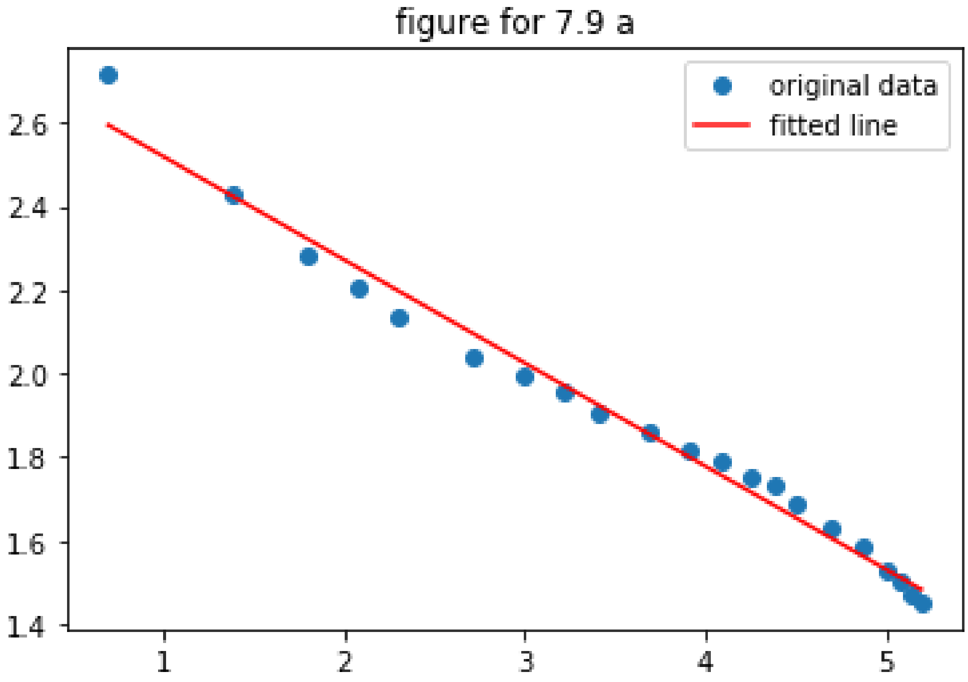
At http://www.statsci.org/data/general/brunhild.html, you will find a dataset that measures the concentration of a sulfate in the blood of a baboon named Brunhilda as a function of time. Build a linear regression of the log of the concentration against the log of time.

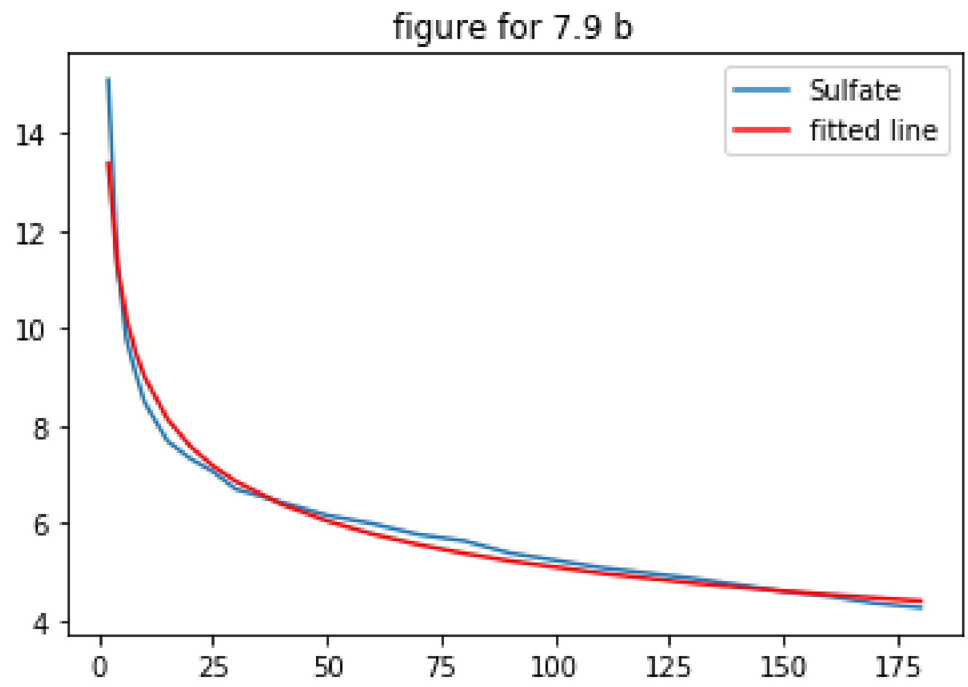
- Prepare a plot showing (a) the data points and (b) the regression line in log-log coordinates.
- Prepare a plot showing (a) the data points and (b) the regression curve in the original coordinates.
- Plot the residual against the fitted values in log-log and in original coor-dinates.
- Use your plots to explain whether your regression is good or bad and why.

```
In [30]: import pandas as pd
         import numpy as np
         import matplotlib
         import matplotlib.pylab as plt
         # import statsmodels.api as sm
         from scipy.stats import linregress

         %matplotlib inline

         df = pd.read_table('brunhild.txt')
         x_log = np.log(df.Hours)
         y_log = np.log(df.Sulfate)
```

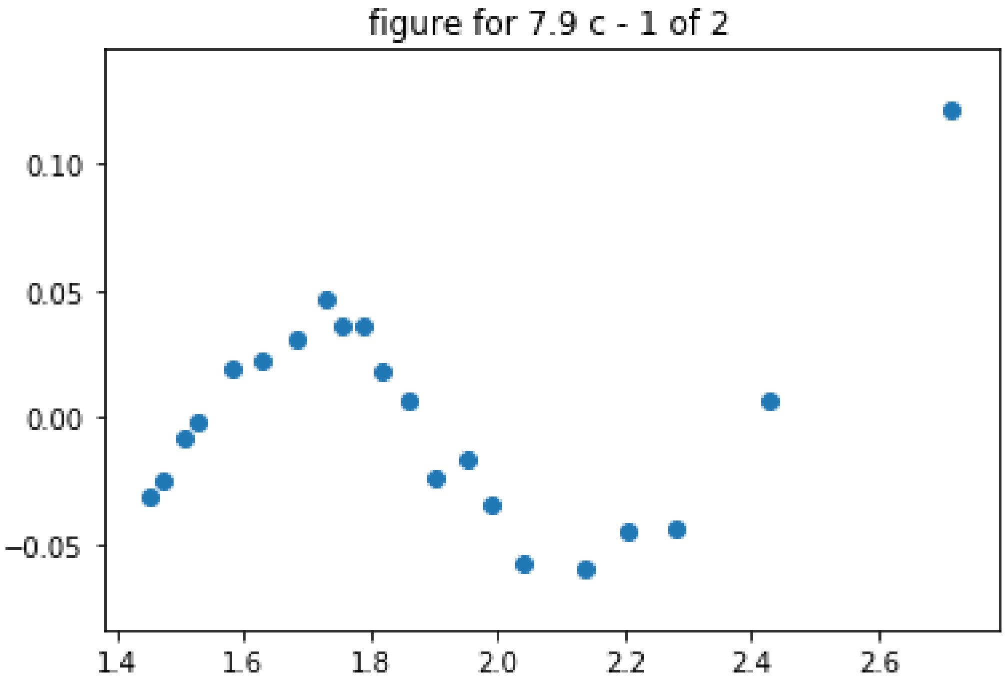
```
In [31]: # ref: https://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.linregress.ht
         slope, intercept, r_value, p_value, std_err = linregress(x_log, y_log)
         plt.plot(x_log, y_log, 'o', label='original data')
         plt.plot(x_log, intercept + slope*x_log, 'r', label='fitted line')
         plt.legend()
         plt.title("figure for 7.9 a")
         plt.show()
```



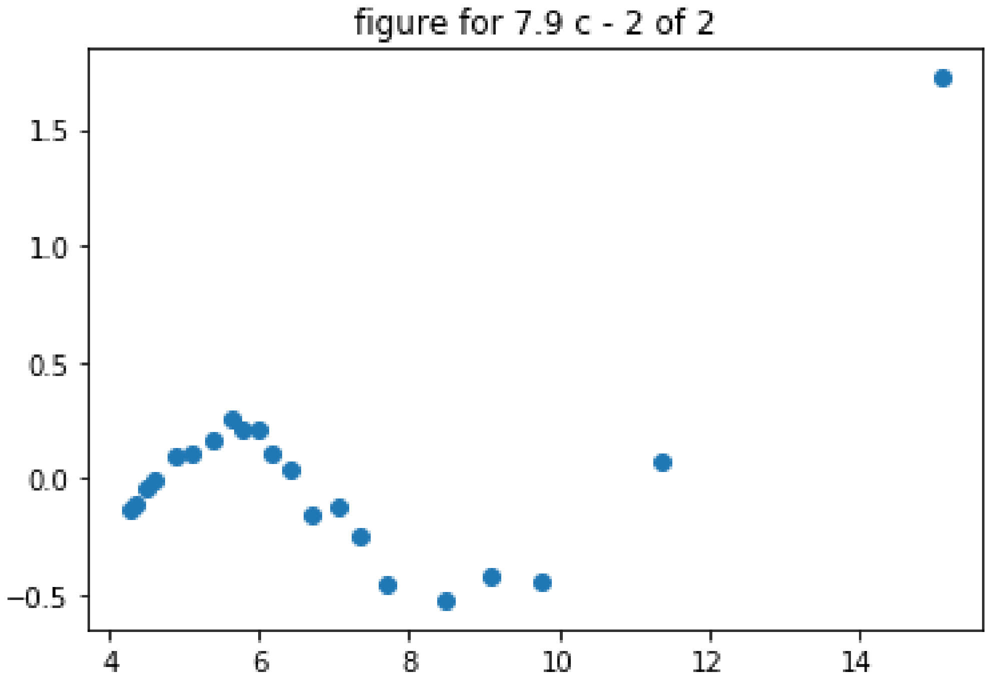
```
In [32]: y_log_predicted = slope * x_log + intercept
         y_log_residual = y_log - y_log_predicted

In [33]: x = df.Hours
         y = df.Sulfate

         y_predicted = np.exp(y_log_predicted)

         plt.plot(x, y)

         plt.plot(x, y_predicted, 'r', label='fitted line')
         plt.legend()
         plt.title("figure for 7.9 b")
         plt.show()
```



```
In [34]: y_residual = y - y_predicted

         plt.scatter(y_log, y_log_residual)
         plt.title("figure for 7.9 c - 1 of 2")
         plt.show()
```



```
In [35]: plt.scatter(y, y_residual)
         plt.title("figure for 7.9 c - 2 of 2")
         plt.show()
```



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A log-log regression seems to be a good fit for this data. The residual plot averages that 0 and except one outlier data point, it follows the data closely.