Oregon State University

CS 325 - Group Assignment 4

Linear Programming

Group 40

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1. A description for a linear program for finding the best fit curve for temperature data.

$$T(d) = \underbrace{x_0 + x_1 \cdot d}_{\text{linear trend}} + \underbrace{x_2 \cdot \cos\left(\frac{2\pi d}{365.25}\right) + x_3 \cdot \sin\left(\frac{2\pi d}{365.25}\right)}_{\text{seasonal pattern}} + \underbrace{x_4 \cdot \cos\left(\frac{2\pi d}{365.25 \times 10.7}\right) + x_5 \cdot \sin\left(\frac{2\pi d}{365.25 \times 10.7}\right)}_{\text{solar cycle}}$$

We can solve this by solving the following LP with 2n inequalities, two for each data point:

Minimize: z

Constraints:

z >= t_i - (x0 + (x1*d_i) + (x2*cos((2*pi*d_i)/365.25)) + (x3*sin((2*pi*d_i)/365.25))
+ (x4*cos((2*pi*d_i)/3908.175)) + (x5*sin((2*pi*d_i)/3908.175))) *for all* i

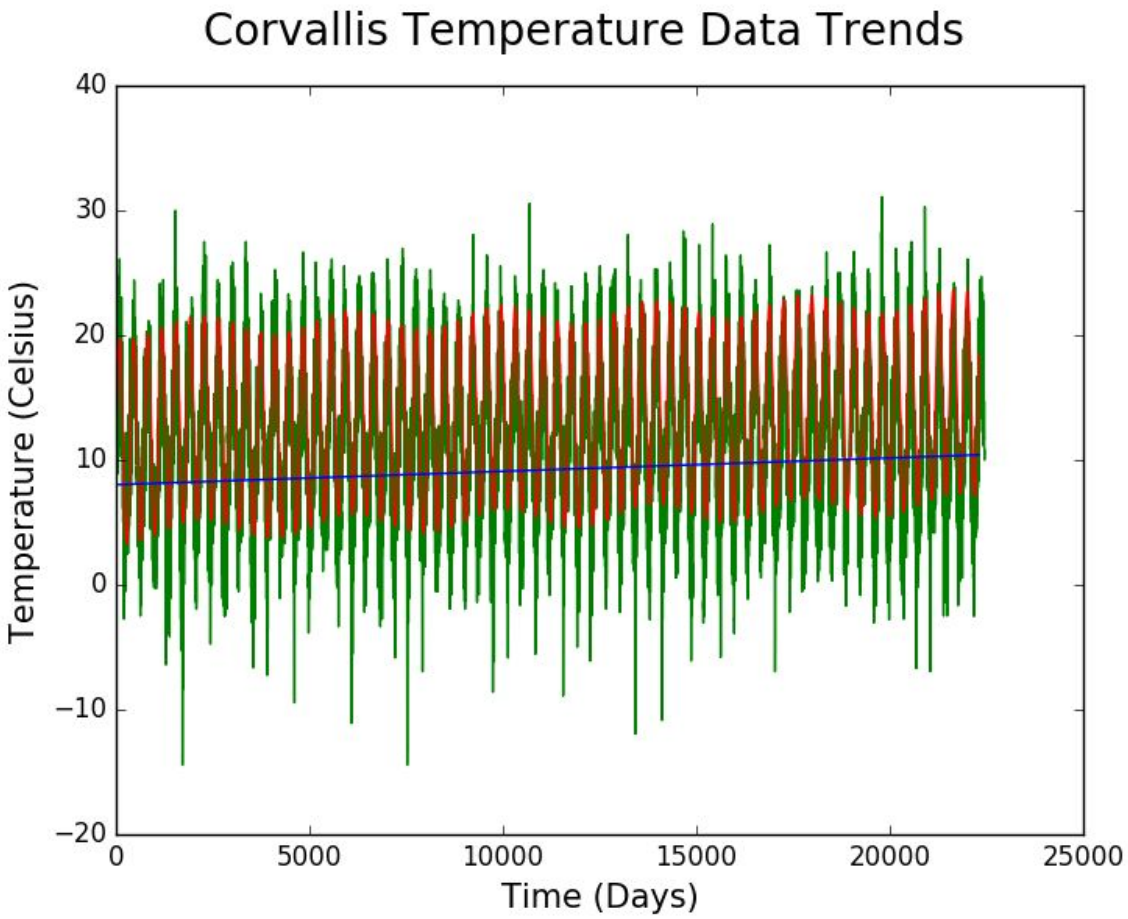
-z <= t_i - (x0 + (x1*d_i) + (x2*cos((2*pi*d_i)/365.25)) + (x3*sin((2*pi*d_i)/365.25))
+ (x4*cos((2*pi*d_i)/3908.175)) + (x5*sin((2*pi*d_i)/3908.175))) *for all* i

2. The values of all of the variables to your linear program in the optimal solution that your linear program solver finds for the Corvallis data.

OUTPUT:

```
10-249-79-217:Project_4 Frog$ python as_4.py Corvallis_data.csv
----- RESULTS -----
x0 = 8.02142
x1 = 0.000106948
x2 = 4.28089
x3 = 8.18686
x4 = -0.790631
x5 = -0.29536
```

3. A single plot that contains: the raw data plotted as points, your best fit curve, and the linear part of the curve x0 + x1* d.



Key:
Green = Raw Data Plotted as points
Red = Best Fit Curve
Blue = Best Fit Linear Part of the Curve

4. Based on the value x1 how many degrees Celsius per century is Corvallis changing and is it a warming or cooling trend?

Linear Trend: T(d) = 8.02142 + (0.000106948*d)

Line has a positive slope and therefore T(d) is increasing as a function of d. This shows Corvallis is warming up.

Number of Days in a century: 365.25*100 = 36525

Degree Change Per Century = (0.000106948*(36525))
Degree Change Per Century = 3.9062757 ˚C