Time Series Analysis
Lecture 2

Regression With Time Series, An Introduction to Exploratory Time Series Data Analysis and Time Series Smoothing

datascience@berkeley

Linear Time Trend Regression

Keep in mind that we are estimating the following linear regression model:

$$y_t = \beta_0 + \beta_1 t + \epsilon_t$$

```
Call:
lm(formula = gtemp ~ time(gtemp))

Residuals:
     Min       1Q   Median       3Q      Max 
-0.31946 -0.09722  0.00084  0.08245  0.29383 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept) -1.120e+01  5.689e-01  -19.69   <2e-16 ***
time(gtemp)  5.749e-03  2.925e-04   19.65   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1251 on 128 degrees of freedom
Multiple R-squared:  0.7511,	Adjusted R-squared:  0.7492 
F-statistic: 386.3 on 1 and 128 DF,  p-value: < 2.2e-16
```

Note the use of the time() function.

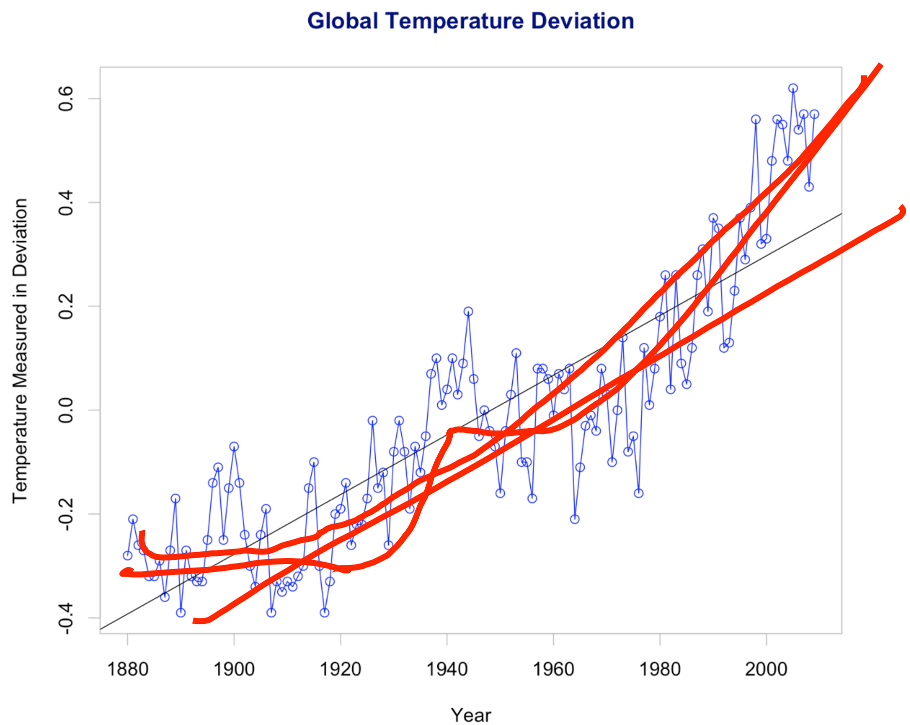
```
> head(time(gtemp))
[1] 1880 1881 1882 1883 1884 1885
```

The estimated regression line takes the following form

$$\hat{y}_t = -11.2 + 0.006t$$

The standard errors are 0.0569 and 0.0003 for $\hat{\beta}_0$ and $\hat{\beta}_1$, respectively.

Importantly, this model, even without verifying the underlying statistical assumption, obviously does not do a good job capturing the pattern of the series, despite the relatively decent R^2.



Berkeley SCHOOL OF INFORMATION