

Exercises for Computational Physics (physik760)

WS 2019/2020

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Exercises for the week from 18th to 22nd of November 2019.

Autocorrelation

1: This is a continuation from last week. Download the global temperature anomaly data set

`http://data.giss.nasa.gov/gistemp/taledata_v3/GLB.Ts+dSST.csv`

or

`https://ecampus.uni-bonn.de/goto_ecampus_file_1141356_download.html`

and understand its content.

- a) compute the autocorrelation function using the corresponding R function for the mean yearly anomaly, determined from the average over the four quarters of the year.
- b) implement your own function to compute the autocorrelation function plus error estimate
- c) compute an estimate of the integrated autocorrelation time on this data set.

Regression towards the mean

2: Let X_1, X_2 be independent and normally distributed random variables with mean zero and variance one. Consider $Y = X \cdot Y$.

- Write a simulation programme to determine mean and variance of Y .
- Use the programme to determine the probability for $Y < -\text{sd}(Y)$?
- Use the programme to determine the probability for $Y < -\text{sd}(Y)$ given $X_1 > n \cdot \text{sd}(X_1)$, with $n = 0, 1, 2, 3, 4$.

What do you conclude from this? (make sure your results are independent of your sample size!)