Data Analysis in Astronomy and Physics (SoSe22)

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Exercise Set 11

Due: **10:00 27 June 2022**
Discussion: **13:00 1 July 2022**
Online submission at via ILIAS in the directory Exercises / Übungen -> Submission of Exercises / Rückgabe des Übungsblätter

1. Interpolating a function of one variable [50 points]

Load the data in `sparse_1.dat`. You will try to find a smooth the data using interpolation.
a) Plot the data. Can you identify the trend? **10 points**
b) Smooth the data by interpolating the data at a larger number of x-coordinates. You can use the `interp1d` method in `scipy.interpolate` using the linear method (or interpolate the points manually). Plot your interpolated points with the original data points **20 points**
c) Test a few other methods ('nearest', 'zero', 'slinear', 'quadratic', and 'cubic') to interpolate the data. Compare them to the linear method. Which appears to be most accurate? Can you identify the underlying function? **20 points**

2. Smoothing a noisy signal [50 points]

Load the data in `data_noisy.dat`. Here you will find columns for x, y_1, and y_2. You will investigate how well the data can be smoothed using different filters.
a) Apply a moving-average filter to both datasets with 10- and 20-point filters. Compare this to 10- and 20-point triangular smoothing of both datasets. Discuss the difference between these methods, and how accurate is the interpolated data. Plot any filtered data with the original dataset. **20 points**
b) Apply the Savitzky-Golay filter to both datasets and plot them. How does this method compare to the previous ones? **30 points**