Exercises

Get together in groups of three (max four) and prepare this small project as a conversation starter for the oral exam on Wednesday 16th in the time frame from 16:00 - 20:00. Note, this will only be a conversation starter and does not exhaustively cover all possible questions during the exam. You may also solve this problem individually.

0 Nahuelbuta weather station

The data file contains data from a weather station in Nahuelbuta.

- Read in the CSV file `"data0_no_time.csv"`. (use `np.loadtxt()` and `delimiter=","`)
- Write a function that filters out the invalid values (-9999.0) from the data.
- Plot the first (air temperature in deg C) and second column (solar radiation $\frac{Watt}{m^2}$) in two separate plots.
- The time information is missing, try to figure out from what time period the data is.

Exercises

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1 A GPS Station in Antarctica

Load data *XYShirase_GPS_Small.txt*. This datafile was recoreded by a GPS station on an Antarctica Ice shelf. The data structure is as follows:

col1: coordinate polar stereographic East (m)
col2: coordinate polar stereographic South (m)
col3: coordinate longitude (decimal degrees)
col4: coordinate latitude (decimal degrees)
col5: elevation (m, relative to WGS84)
col6: days (relative to an arbitrary date in the past)

Visual the vertical coordinate as a function of time. Visualize the horizontal trajectory of the station. Fit a linear regression line to the horizontal trajectory. What is the approximate speed in meters per year?

Exercises

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2 Min, Max, Mean

- Read in data from the user as input from the command line. If the user types ”x” stop reading.
- Write a function that calculates the min, max and mean values from that input. The function should return a tuple (a, b, c) containing the three values
- Print the values at the end

Exercises

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3 Daily average

The data given is from one year (2017) of the weather station in Santa Gracia. There are 24 values per day (1 hour average).

- Read in the CSV file `"data3.csv"`. (use `np.loadtxt()`, `delimiter=","` and `usecols=(1,2)`)
- Write a function that filters out the invalid values (-9999.0) from the data.
- Write a function that calculates the average for each day (average over 24 values).
- Plot the data: first column contains air temperature, second column contains air relative humidity.

Exercises

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4 Derivative

The data given is from one year (2018) of the weather station in Santa Gracia. There are 24 values per day (1 hour average).

- Read in the CSV file `"data4.csv"`. (use `np.loadtxt()`, `delimiter=","` and `usecols=(1,2)`)
- Write a function that filters out the invalid values (-9999.0) from the data.
- Write a function that calculates the first and second derivative.
- Plot the data: first column contains the average wind speed, second column contains the maximum wind speed.

Exercises

Get together in groups of three (max four) and prepare this small project as a conversation starter for the oral exam on Wednesday 16th in the time frame from 16:00 - 20:00. Note, this will only be a conversation starter and does not exhaustively cover all possible questions during the exam. You may also solve this problem individually.

5 Smoothing Data

Load data *XYShirase_GPS_Small.txt*. This datafile was recoreded by a GPS station on an Antarctica Ice shelf. The data structure is as follows:

col1: coordinate polar stereographic East (m)
col2: coordinate polar stereographic South (m)
col3: coordinate longitude (decimal degrees)
col4: coordinate latitude (decimal degrees)
col5: elevation (m, relative to WGS84)
col6: days (relative to an arbitrary date in the past)

Visualize the vertical displacement as a function of time. The data are a bit noisy for your liking. Smooth the data with a running mean. This means, write a for loop that goes through the data and for each point in time you average values in its surrounding. This is called a running mean. It is not the best way to smooth data, but a good exercises. Write your own loop, don't use external functions.

Exercises

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6 A bit of geophysics, but not too much.

The data file is a derived product from a radar survey in Antarctica. The radar was towed behind a skidoo with lots of driving around. The data format is as follows:

col1: coordinate polar-stereographic East (m)
col2: coordinate polar-stereographic South (m)
col3: two-way traveltime to a sub-surface reflector (seconds)

Filter out all the NaN values. Visualize the skidoo-tracks in an x-y plot. Write a function that converts the two-way traveltime of the sub-surface reflector to a depth below the surface. Assume a radio-wave velocity of $1.72 \cdot 10^8$ m s^{-1}. What is the average depth of the sub-surface reflector in meters? Can you visualize this using the scatter function in matplotlib?

Exercises

Get together in groups of three (max four) and prepare this small project as a conversation starter for the oral exam on Wednesday 16th in the time frame from 16:00 - 20:00. Note, this will only be a conversation starter and does not exhaustively cover all possible questions during the exam. You may also solve this problem individually.

7 Polynomial

The data given is from one month (2022.04) of the weather station in Nahuelbuta. There are 24 values per day (1 hour average).

- Read in the CSV file `"data5.csv"`. (use `np.loadtxt()`, `delimiter=","` and `usecols=(1,2)`)
- Write a function that filters out the invalid values (-9999.0) from the data.
- Take one of the precipitation peaks (for example on 2022-04-24) and try to fit a second order polynomial using the function `polyfit`.
- Plot the data: first column contains the solar radiation, second column contains the precipitation.

Exercises

Get together in groups of three (max four) and prepare this small project as a conversation starter for the oral exam on Wednesday 16th in the time frame from 16:00 - 20:00. Note, this will only be a conversation starter and does not exhaustively cover all possible questions during the exam. You may also solve this problem individually.

8 A bit of geophysics, but not too much.

The data file is a derived product from a radar survey in Antarctica. The radar was towed behind a skidoo with lots of driving around. The data format is as follows:

col1: coordinate polar-stereographic East (m)
col2: coordinate polar-stereographic South (m)
col3: two-way traveltime to a sub-surface reflector (seconds)

Filter out all the NaN values. Visualize the skidoo-tracks in an x-y plot. Write a function (containing a for loop) that calculates the total distance travelled. The function should stop the calculation if the distance between two datapoints is larger than 500 m.