Intelligent Data Analysis

1. Tutorial

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Goals

The goal of this tutorial is to collect initial experience in working with MATLAB. In this tutorial you learn some basic programming concepts of MATLAB by working on various small tasks.

Task 1

Solving linear equations is often used to extract relationships in data. A linear equation can be displayed in the following general form:

$$\begin{array}{ccccccc} a_{11}x_1 & + & a_{12}x_2 & +\cdots+ & a_{1n}x_n & = & b_1 \\ a_{21}x_1 & + & a_{22}x_2 & +\cdots+ & a_{2n}x_n & = & b_2 \\ & & & \vdots & & & \\ a_{m1}x_1 & + & a_{m2}x_2 & +\cdots+ & a_{mn}x_n & = & b_m. \end{array}$$

Solve the following linear equation in MATLAB:

$$\begin{array}{ccccccc} 3x_1 & + & 2x_2 & - & x_3 & = & 1 \\ 2x_1 & - & 2x_2 & + & 4x_3 & = & -2 \\ -x_1 & + & \frac{1}{2}x_2 & - & x_3 & = & 0. \end{array}$$

Task 2

Create the graph from Figure 1.

- Subplot 1 shows n random points and has the title "Zufallswerte".
- Subplot 2 shows the function sin(x) for the interval of $x \in [-\pi, \pi]$ and has the title "sin(x)"
- Subplot 3 shows a graphic with the title "Bild: filename". The filename is intended to show the path of the displayed image (eg, logo.gif).
- Subplot 4 shows a histogram of the occurring color values (0-255) for the graphic from Subplot 3. Use a histogram with the following bins: 0-9, 10-19, ... , 250-255.

Note: The instructions `figure, subplot, title, hist, imread, double, hold` may be helpful.

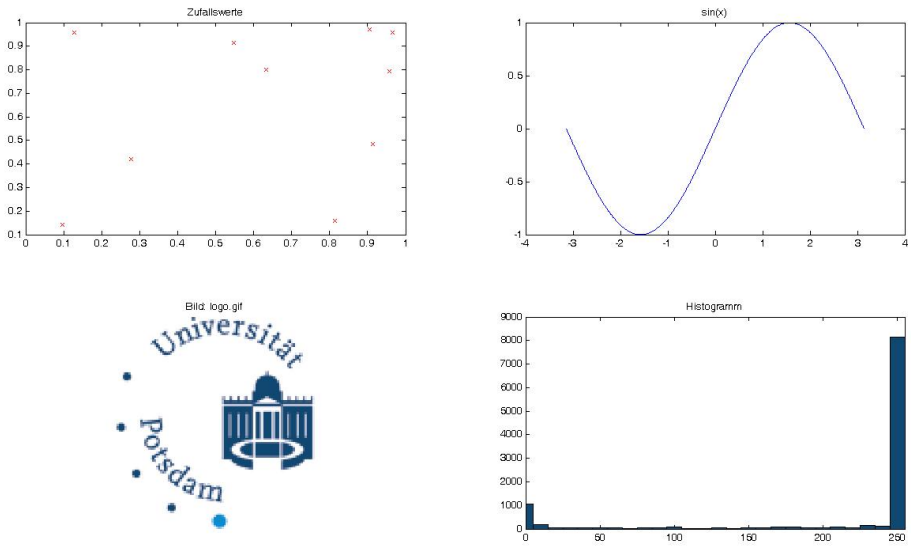

Figure 1: Beispielplots mit MATLAB

Task 3

Sorting functions are often used to organize elements of a vector. MATLAB already has a sorting function called `sort`. Implement a MATLAB function that sorts a given vector of numbers with the sorting method "Mergesort".

```
function X = mergesort(List, descending)
% X = mergesort(List, descending)
%
% if descending = 0 then sort vector List of values [v1 v2 ...  vn] in 'ascending'
order,
% else in 'descending' order
```