Addon zu den Übungsaufgaben I, SBV1

Lisa Panholzer, Lukas Fiel

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1 Übungsaufgaben I, addon

1.1 Stressanalyse

a) Recherche

b) Analyse der EKG Sequenzen

c) Herzratenvariablität

Analyse des Hautleitwerts

1.2 Geschwindigkeitsermittlung

a) Ermittlung von Geschwindigkeit und Distanz

*A*ufgabenstellung: Zu untersuchen war ein Datensatz, der mit Daten eines Beschleunigungssensors gefüllt war. Neben den Daten des Sensors waren auch Zeitstempel enthalten mit denen eine Ermittlung der Abtastzeit möglich war. Bekannt war weiters, dass es sich um die Daten einer geradlinigen Bewegung entlang einer Tischkante handelte die etwa 2 m lang war. Eine Darstellung dieser Daten kann Figure 1 entnommen werden.

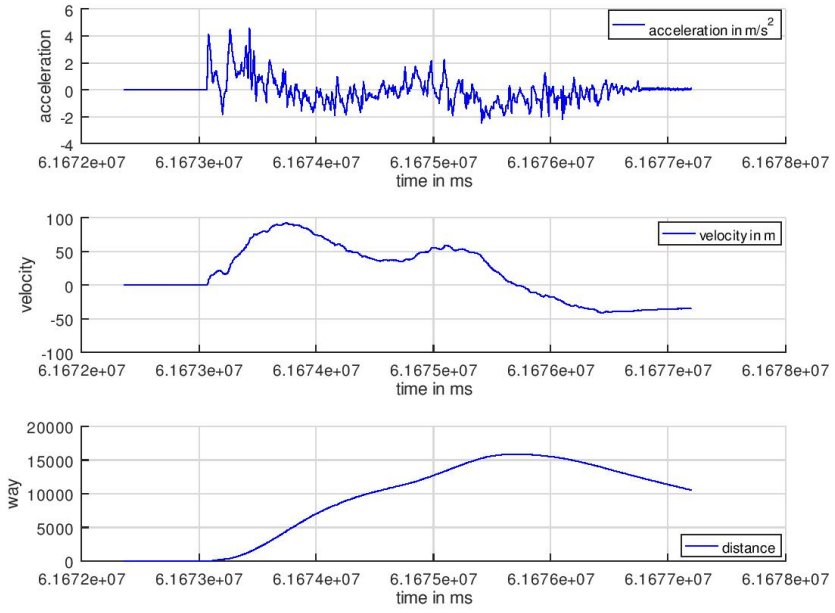

Figure 1: Die Daten des Beschleunigungssensors wurden aufsummiert um die Geschwindigkeit zu erhalten. Dieser Prozess wurde wiederholt um einen ersten Eindruck über ein mögliches Wegsignal aussehen könnte.

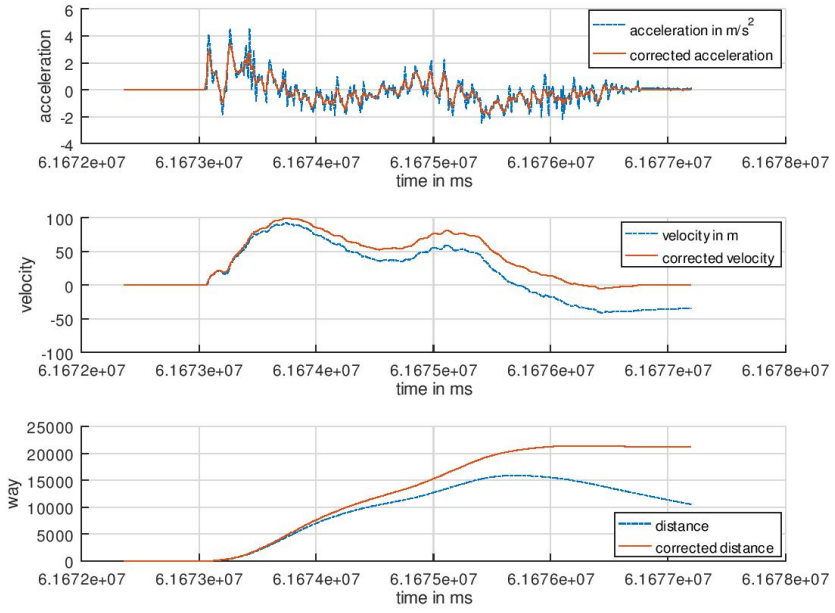

Figure 2: Gefilterte und korrigierte Darstellung der Daten.

```
    ; columns
```

```
clc
clear all
close all

pkg load io

'load_files_from_'
folderPath = 'C:/Users/Lukas/Documents/Signal-_und_Bildverarbeitung/workspace/project/
    ↪ plugins/SBVplugin/SBVaddon/testData/';
fileName = 'acceleration.csv';
filePath = [folderPath, fileName]

acceleration = xlsread(filePath, 'tisch2m', 'A2:B577');

'process_plain_data'
velocity(1) = 0; # assume the velocity to be zero at the beginning
N = length(acceleration(:,1));
for j=2:N
  velocity(j) = acceleration(j,2) + velocity(j-1);
endfor

way(1) = 0; # assume the way to be zero at the beginning
for j=2:N
  way(j) = velocity(j) + way(j-1);
endfor

'plot_plain_data'
fig1 = figure();
subplot(3,1,1);hold on;
xlabel("time_in_ms");
ylabel("acceleration");
grid on
plot(acceleration(:,1),acceleration(:,2),"-b;acceleration_in_m/s^2;");
```

```
subplot(3,1,2);hold on;
xlabel("time in ms");
ylabel("velocity");
grid on
plot(acceleration(:,1),velocity,"-b;velocity in m;")
subplot(3,1,3);hold on;
xlabel("time in ms");
ylabel("way");
grid on
plot(acceleration(:,1),way,"-b;distance;")
legend("location","southeast");

'begin CORRECTION'
# ACCELERATION CORRECTION
    ↪ ##############################################################################
time = acceleration(:,1);
correctedAcceleration = acceleration(:,2);
# ACCELERATION - floating mean filter
radius = 2;
mask = 2 * radius +1;
for j = (radius+1) : N- (radius+1)
  correctedAcceleration(j) = mean(correctedAcceleration(j-radius:j+radius));
endfor

# ACCELERATION - threshold
THRESHOLD = 0.12;
for j = (radius+1) : N - (radius+1)
  meanValue = abs(mean(correctedAcceleration(j-radius:j+radius)));
  if (meanValue < THRESHOLD)
    correctedAcceleration(j) = 0;
  endif
endfor
correctedAcceleration(1:radius) = correctedAcceleration(radius+1);
correctedAcceleration(N-radius:N) = correctedAcceleration(N-radius-1);

# VELOCITY CALCULATION
correctedVelocity(1) = 0; # assume the velocity to be zero at the beginning
N = length(time);
for j=2:N
  correctedVelocity(j) = correctedAcceleration(j) + correctedVelocity(j-1);
endfor

# VELOCITY CORRECTION

# find indizes of actual movement in accelerator data
nonzeroIndizes = find(correctedAcceleration(:)); # find nonzero data
lastPrecedentZeroIndex = min(nonzeroIndizes); # get first nonzero index
lastNonZeroIndex = max(nonzeroIndizes); # get last nonzero index

# calculate line from first meaningful data to the last
k = correctedVelocity(length(correctedVelocity))/(lastNonZeroIndex -
    ↪ lastPrecedentZeroIndex);
d = - k * lastPrecedentZeroIndex;
correctedVelocity(1:lastPrecedentZeroIndex) = 0; # if there is no acceleration -> set
    ↪ velocity to 0
correctedVelocity(lastNonZeroIndex:N) = 0; # if ther is no acceleration -> set velocity
    ↪ to 0
for j=lastPrecedentZeroIndex:lastNonZeroIndex-1
  correctedVelocity(j) = correctedVelocity(j) + abs(k * j + d);
endfor


correctedWay(1) = 0; # assume the way to be zero at the beginning
for j=2:N
  correctedWay(j) = correctedVelocity(j) + correctedWay(j-1);
endfor


'plot result'
distance = max(way)
correctedDistance = max(correctedWay)

figure()
subplot(3,1,1)
grid on
hold on
xlabel("time in ms");
```

```
ylabel("acceleration");
plot(acceleration(:,1),acceleration(:,2),"-.;acceleration in m/s^2;");
plot(time,correctedAcceleration,"-;corrected acceleration;");
subplot(3,1,2)
hold on
grid on
xlabel("time in ms");
ylabel("velocity");
plot(acceleration(:,1),velocity,"-.;velocity in m;")
plot(time,correctedVelocity,"-;corrected velocity;");
subplot(3,1,3)
hold on
grid on
plot(time,way,"-.;distance;");
plot(time,correctedWay,"-;corrected distance;");
legend("location","southeast");
xlabel("time in ms");
ylabel("way");
```