

Final project

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Project 1

$$z = Hx + v$$

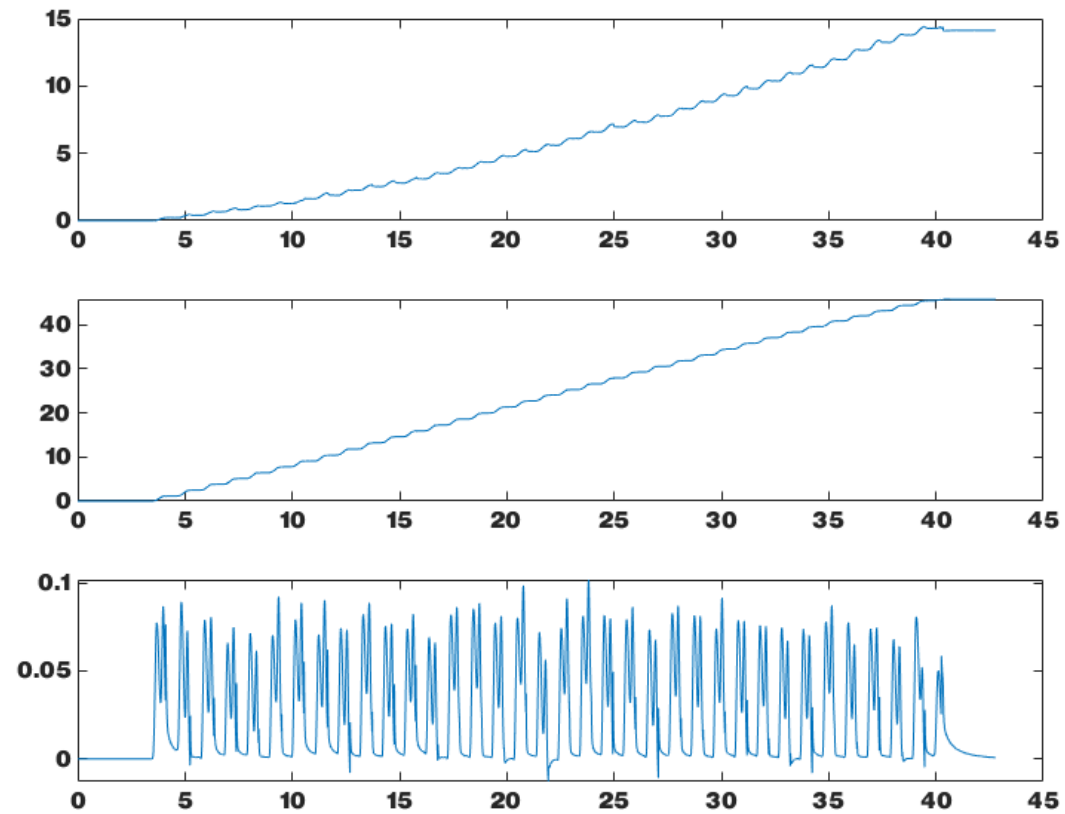
$$[0_{3 \times 1} - \widehat{v}_k] = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} q_{e_{3 \times 1}} \\ r_{e_{3 \times 1}} \\ v_{e_{3 \times 1}} \end{bmatrix} + v_{3 \times 3}$$

$$\begin{array}{ccc} \downarrow & \text{add} \begin{bmatrix} r_x \\ r_y \\ r_z \end{bmatrix} & \downarrow \end{array}$$

$$\begin{bmatrix} 0_{3 \times 1} - \widehat{v}_k \\ 0_{1 \times 1} - [0 \ 0 \ 1] \widehat{r}_k \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} q_{e_{3 \times 1}} \\ r_{e_{3 \times 1}} \\ v_{e_{3 \times 1}} \end{bmatrix} + v_{4 \times 4}$$

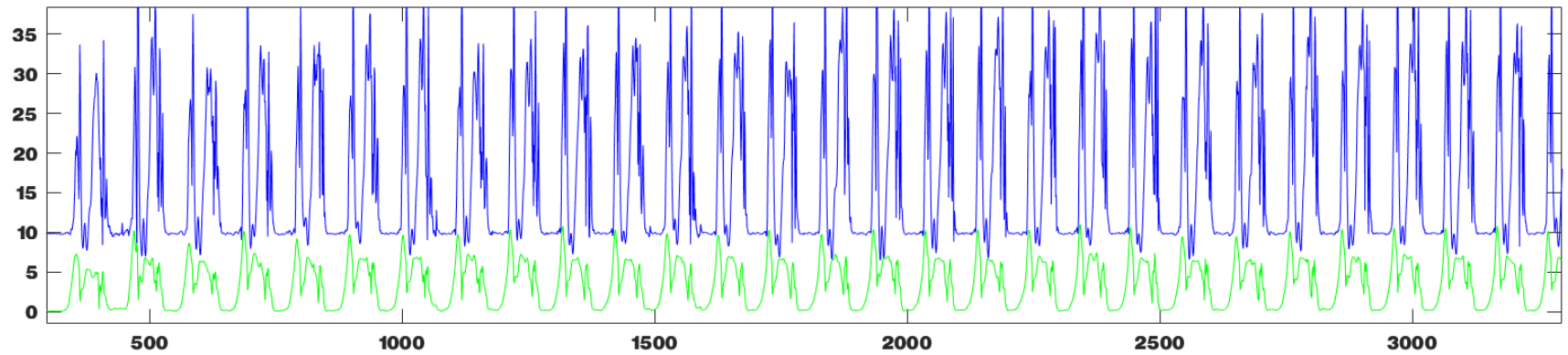
Project 1

Result



Project 2

Algorithm

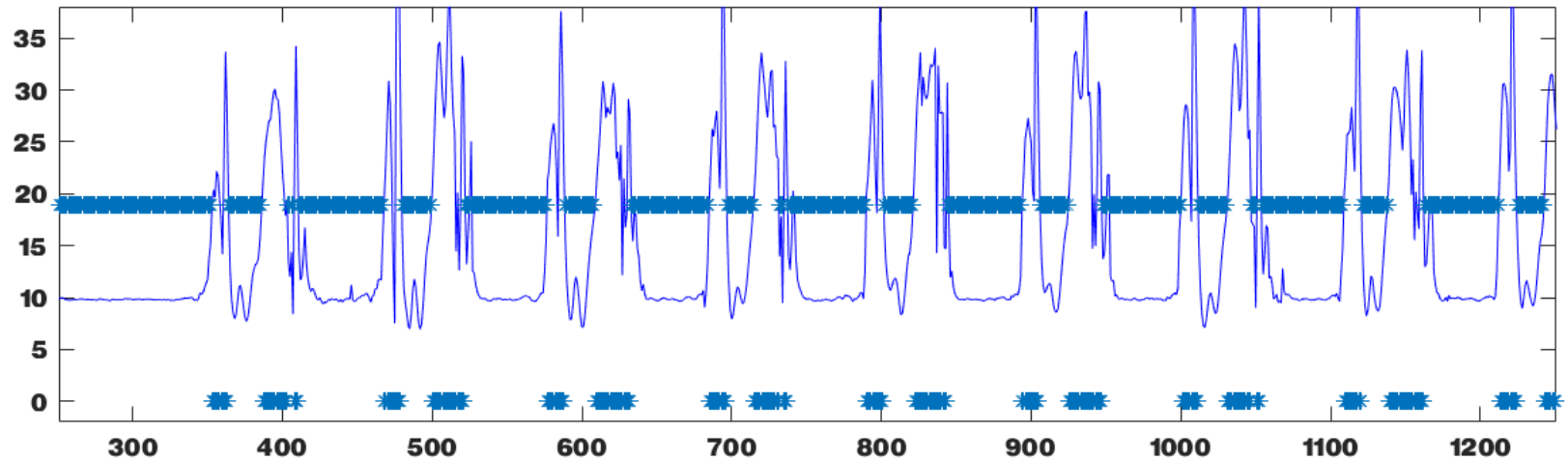


Accelerometer 

Gyroscope 

Project 2

Algorithm



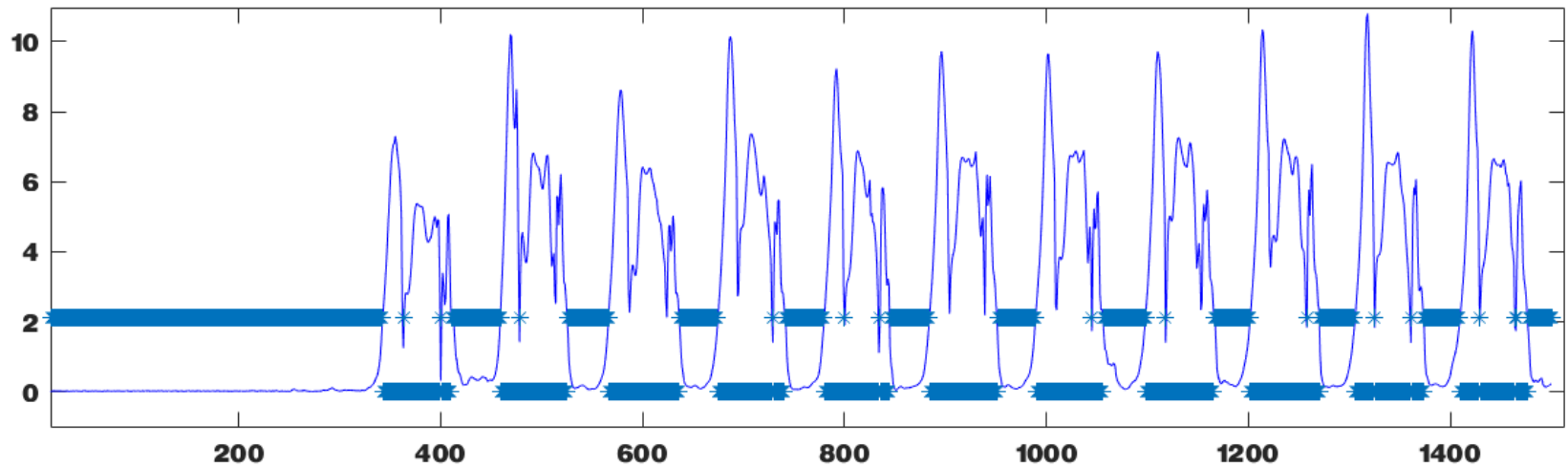
Accelerometer —

Zero velocity graph *

Filter level is 50% of standard deviation of this function

Project 2

Algorithm



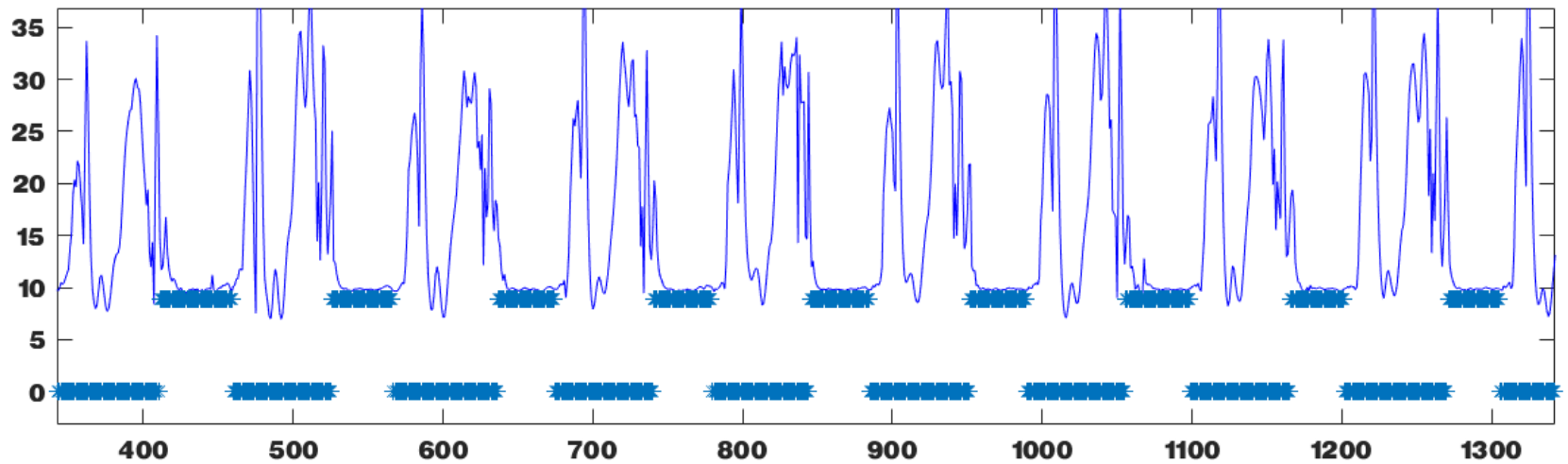
Gyroscope —

Zero velocity graph *

Filter level is 50% of standard deviation of this function

Project 2

Algorithm



After intersection

Accelerometer —

Zero velocity graph *

Project 2

Algorithm

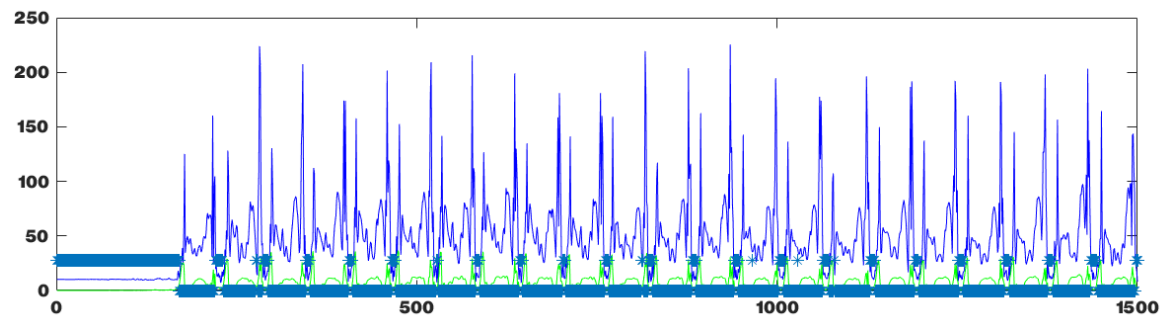
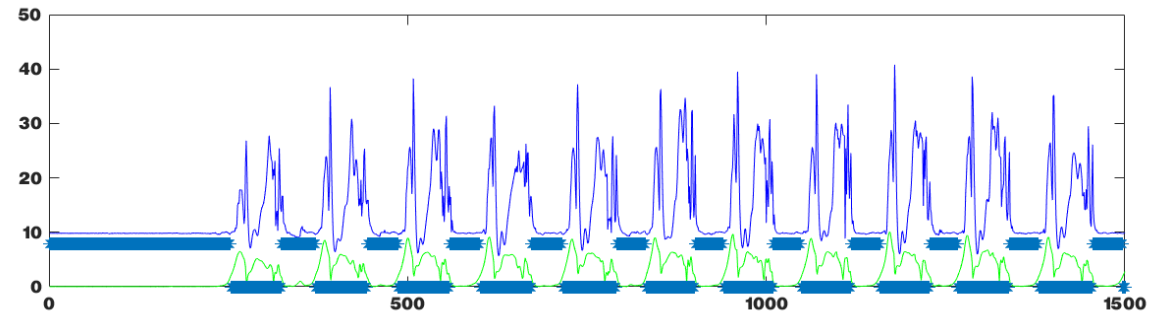
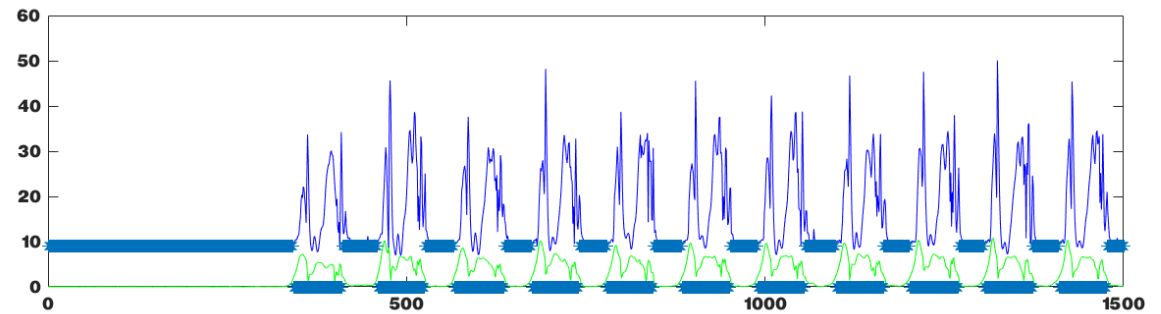
Accelerometer



Gyroscope

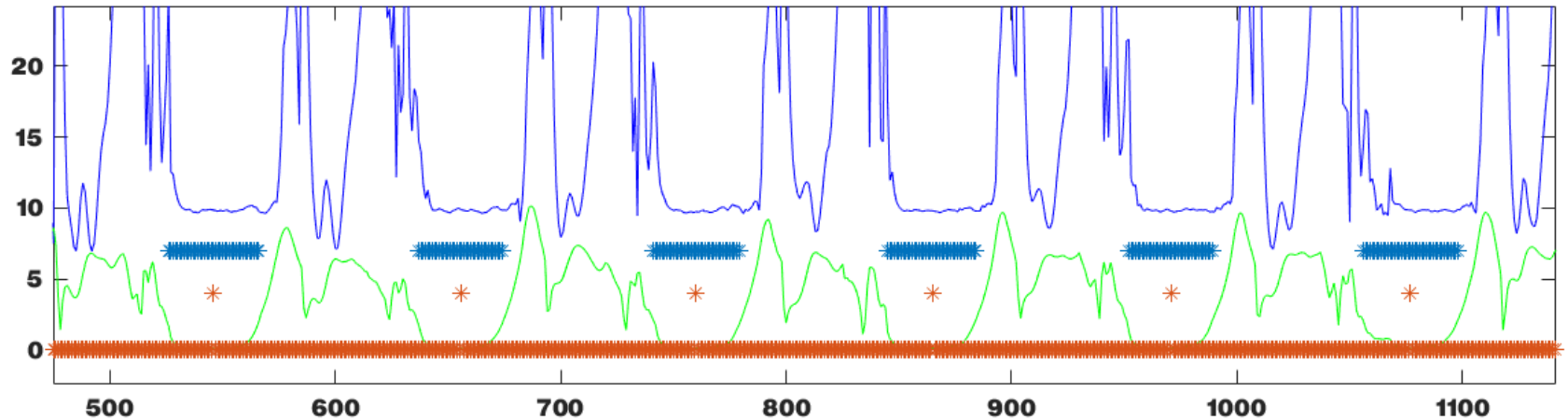


Zero velocity graph



Project 3

Path



$$\text{Step length} = \text{abs}(\|\hat{r}_i - \hat{r}_{i+1}\|)$$

Results		
Long walking 1	Long walking 2	Running
48.257 m	48.204 m	70.958 m

Thank you for everything!

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