

Response to Reviewer 3 Comments

First of all, we would like to thank you for your kind suggestions.

Comments and Suggestions for Authors

The article needs a more complete conclusion to demonstrate the advantages of the solution.

Response: We have rewrote the conclusion and demonstrate the advantages of the solution. Thank you very much!

Aiming at the problem of low step detection accuracy of PDR in unconstrained state, this paper proposes a step detection algorithm for smartphones. In this algorithm, the pseudo-peak are eliminated by preprocessing acceleration using FIR low-pass filter, FFT recognition gait, dynamic updating peak threshold and variable sliding window cooperative time threshold, and finally the step counting is realized.

The FIR low-pass filter is used to denoise the overall acceleration signal. FFT is used to identify stroll walking, normal walking, running and interference state. The minimum peak value after sliding window filter is used to dynamically update the peak value threshold, which solve for the problem that the fixed peak value threshold has low adaptability in unconstrained state. A method of variable sliding window cooperative time threshold is proposed, which ensures the connection between adjacent windows and makes up for the problem that the fixed window cannot judge the initial peak and the end peak. In order to evaluate the step counting performance of the proposed algorithm, 50 experiments in constrained and unconstrained states are conducted by 25 volunteers holding 21 different types of smartphones. The experimental results show that, the average step counting accuracy of the proposed algorithm is 98.4% in unconstrained state, which is 10.0% higher than that of the result from the open source program Stepcount. This proposed algorithm has strong ability to adapt to complex unconstrained states and it is friendly for different genders and mobile phones with different prices. In the future, we plan to carry out indoor positioning research with this step detection method and use it in the construction of smart city and the tracking of pandemics.