**[Edison] Lab Assignment**

# Student Info.

* Student Name 1: Le Huy Hoang Student ID: 1652212
* Student Name 2: Pham Le Song Ngan Student ID: 1652411
* Student Name 3: Tran Nguyen Dang Khoa Student ID: 1552175

# Objectives

* Using 9DOF Block to develop an application for **step counting**.
* Perform experiments on various scenarios (slow walking, normal walking, long walking, false walking) and record experimental results.
* Interpret your experimental results.

# Report

1. Present the method (for step counting) which you use to develop your application.

* Collect sensing data for each activity and plot several samples to observe the data pattern of each activity.
* Analyse the pattern and design the algorithm to classify the difference between various activities.

We took the reference data, activities and algorithm classification from the paper: ***A More Reliable Step Counter using Built-in Accelerometer in Smartphone - Win Win Myo, Wiphada Wettayaprasit, Pattara Aiyarak***

* Implement the algorithm:

|  |
| --- |
| *input:*  *a : array of raw accelerometer values*  *n : number of elements in array a*  *output:*  *total: number of steps recognized*  *---------------------------------------------------*  *init:*  *p : empty array*  *step = 0*  *delta = 5*  *for i in range(delta, n):*  *if a[i] == max\_of\_interval(a[i - delta], a[i + delta]):*  *p[i] = 1*  *i++*  *k = 0*  *D = 0*  *for j in range(0, n):*  *if p[j] == 1:*  *if k == 0:*  *D = j - k - 1*  *if D > 2:*  *step++*  *j++*  *if j == n:*  *D = n - k*  *if D > 2:*  *step++*    *total = step*  *return total* |

1. Summary experimental results

Table 1. Experimental Results on **Scenario 1** (Normal Walking)

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Results on Application | Correct Results | Error |
| 1 | 10 | 7 | 3.0 |
| 2 | 12 | 8 | 4.0 |
| 3 | 20 | 15 | 5.0 |
| 4 | 20 | 13 | 7.0 |
| 5 | 18 | 12 | 6.0 |
| 6 | 17 | 9 | 8.0 |
| 7 | 21 | 16 | 5.0 |
| 8 | 15 | 12 | 3.0 |
| 9 | 16 | 10 | 6.0 |
| 10 | 17 | 12 | 5.0 |
| Max | | | **8.0** |
| Min | | | **3.0** |
| Average | | | **5.2** |
| Standard Deviation () or Variance () | | | **= 2.62**  **= 1.62** |

Table 2. Experimental Results on **Scenario 2** (Slow Walking)

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Results on Application | Correct Results | Error |
| 1 | 11 | 7 | 4.0 |
| 2 | 13 | 9 | 4.0 |
| 3 | 13 | 8 | 5.0 |
| 4 | 12 | 8 | 4.0 |
| 5 | 14 | 12 | 2.0 |
| 6 | 11 | 8 | 3.0 |
| 7 | 9 | 5 | 4.0 |
| 8 | 10 | 9 | 1.0 |
| 9 | 8 | 5 | 3.0 |
| 10 | 9 | 7 | 2.0 |
| Max | | | **5.0** |
| Min | | | **1.0** |
| Average | | | **3.2** |
| Standard Deviation () or Variance () | | | **= 1.51**  **= 1.23** |

Table 3. Experimental Results on **Scenario 3** (Long Walking)

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Results on Application | Correct Results | Error |
| 1 | 14 | 6 | 8.0 |
| 2 | 13 | 7 | 6.0 |
| 3 | 10 | 6 | 4.0 |
| 4 | 12 | 7 | 5.0 |
| 5 | 10 | 7 | 3.0 |
| 6 | 10 | 7 | 3.0 |
| 7 | 10 | 6 | 4.0 |
| 8 | 13 | 6 | 7.0 |
| 9 | 11 | 6 | 5.0 |
| 10 | 13 | 7 | 6.0 |
| Max | | | **8.0** |
| Min | | | **3.0** |
| Average | | | **5.1** |
| Standard Deviation () or Variance () | | | **= 2.77**  **= 1.66** |

Table 4. Experimental Results on **Scenario 4** (False Walking)

In this table, we do 2 kind of actions:

1 – 5 : we run all the time, thus the Normal walking step is 0

6 – 10: while running, we do 10 normal walking steps

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Results on Application | Normal walking steps | Error |
| 1 | 1 | 0 | 1 |
| 2 | 10 | 0 | 10 |
| 3 | 6 | 0 | 6 |
| 4 | 11 | 0 | 11 |
| 5 | 10 | 0 | 10 |
| 6 | 12 | 8 | 4 |
| 7 | 7 | 10 | 3 |
| 8 | 6 | 10 | 4 |
| 9 | 8 | 10 | 2 |
| 10 | 9 | 10 | 1 |
| Max | | | **11** |
| Min | | | **1** |
| Average | | | **5.2** |
| Standard Deviation () or Variance () | | | **= 14.84**  **= 3.85** |

Table 5. Summary of Experimental Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Scenarios** | **Max Error** | **Min Error** | **Average** | **Covariance** |
| Slow Walking | **5.0** | **1.0** | **3.2** | **1.51** |
| Normal Walking | **8.0** | **3.0** | **5.2** | **2.62** |
| Long Walking | **8.0** | **3.0** | **5.1** | **2.77** |
| False Walking | **11** | **1** | **5.2** | **14.84** |

1. Summary your analysis and comment:

The collected data did not exactly correct to the actual results. Due to the declassification of different activities while designing the algorithms.

The false walking resulted the distinct difference from other experiments. However, false walking seemed to result the nearly correct data to the actual walking steps.

On the other hand, slow walking showed the likelihood that the algorithm described nearly the same data between the application testing’s and correct movement results.

Normal walking and long walking estimated the same max error and min error between the testing’s and actual results. Their variance was calculated nearly equal.

1. Future study

The future study is aim to do with larger data for pattern analysis of different activities. In step counting studies, there are many positions that human can put the step counter on: waist, hands, legs, ... Besides, there are also many activities in copper with moving such as: texting, swinging, putting the step counters in the bags/ pockets, ... Thus, the patterns must be large and detailed enough to develop the basic algorithm.

The algorithm must be analysed and classfied to different activities and different positions.

Noisy data is unavoidable. Thus, the system should include digital signal processing modal.