**1st experiemnt**

By three different way positioning error was calculated

1. Signature ID matching and RSS distance calculation for each (conditionally) matched Training and Testing signature.
2. Making a common signature in a grid ( one signature per one grid) with all ID , mean RSS value of common ID, and mean value of XY coordinate.
3. As same as approach 2, but Grid centre has been used as XY coordinate.

**Facts:** number of

* Training sample =84100
* Training signature = 16246
* Testing sample = 2000
* Testing signature = 370

**Observation:**

* Smaller grid size giving better performance.
* The more ID match, the better performance and confidence level.
* Average value of matched signature are not giving better result at 68%, but at 95% average values are giving less error.
* One signature per one grid giving better performance.
* Performance of mean XY coordinate (of common signatures) and Grid centre coordinate ( approach 2 and 3) giving nearly same result.

Result of approach 1

Signature ID matching and RSS distance calculation for each (conditionally) matched Training and Testing signature.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of Matched ID out of 7 | Positioning error based on min RSS distance  (in meter) | | Positioning error based on Average of 5 smallest RSS distance\*\*  (in meter) | | Number of matched Testing signature out of 388 | Grid size |
|  | 68% | 95% | 68% | 95% |  | mxm |
| 2 | 32.84 | 152.19 | 37.15 | 87.75 | 386 | 20X20 |
| 3 | 34.08 | 138.65 | 37.79 | 76.77 | 371 |
| 4 | 34.35 | 105.46 | 35.27 | 68.27 | 306 |
| 5 | 28.60 | 81.84 | 31.96 | 61.54 | 147 |
| 6 | 9.28 | 44.33 | 9.87 | 44.66 | 46 |
| 7 | 1.96 | 10.65 | 2.04 | 9.77 | 27 |
|  | | | | | | |
| 2 | 32.18 | 191.72 | 39.01 | 94.51 | 383 | 10X10  383 |
| 3 | 20.30 | 111.46 | 31.47 | 62.98 | 381 |
| 4 | 22.62 | 96.41 | 29.92 | 63.41 | 365 |
| 5 | 18.87 | 79.15 | 24.77 | 50.70 | 260 |
| 6 | 7.58 | 36.37 | 14.48 | 32.96 | 134 |
| 7 | 2.56 | 11.98 | 3.42 | 8.66 | 77 |
|  | | | | | | |
| 2 | 33.0904 | 158.7338 | 41.7154 | 90.2377 | 378 | 5X5  378 |
| 3 | 10.3172 | 113.0075 | 27.8997 | 60.8210 | 378 |
| 4 | 11.0347 | 73.9096 | 25.8434 | 50.5547 | 373 |
| 5 | 10.1674 | 59.6215 | 21.6342 | 42.5841 | 338 |
| 6 | 5.0756 | 41.9529 | 12.8111 | 32.5818 | 241 |
| 7 | 2.1882 | 12.3964 | 3.1769 | 10.6380 | 167 |

Note: Average of 5 signature distance were calculated based on availability. In case of less matched signature, mean value of those were counted.

Result of Approach 2

Making a common signature in a grid ( one signature per one grid) with all ID , mean RSS value of common ID, and mean value of XY coordinate.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of Matched ID out of 7 | Positioning error based on min RSS distance  (in meter) | | Positioning error based on Average of 5 smallest RSS distance\*\*  (in meter) | | Number of matched Testing signature out of 370 | Grid size |
|  | 68% | 95% | 68% | 95% |  | mxm |
| 2 | 92.8883 | 325.1848 | 84.9953 | 176.1154 | 388 | 20 X20 |
| 3 | 58.2208 | 188.9294 | 58.2817 | 110.1269 | All |
| 4 | 44.3250 | 144.8828 | 41.8827 | 83.6775 | All |
| 5 | 33.3072 | 104.1142 | 33.0394 | 64.7831 | All |
| 6 | 21.0915 | 76.9754 | 28.0829 | 48.4998 | All |
| 7 | 13.0089 | 53.6864 | 21.0011 | 36.6726 | All |
|  | | | | | | |
| 2 | 79.2511 | 256.9012 | 73.3745 | 154.4095 | 383 | 10x10 |
| 3 | 53.4671 | 170.7010 | 48.9139 | 105.6510 | All |
| 4 | 37.5498 | 118.4873 | 35.1589 | 72.7928 | All |
| 5 | 27.1996 | 97.3818 | 27.2800 | 52.6662 | All |
| 6 | 15.2519 | 53.3207 | 21.4117 | 37.8878 | All |
| 7 | 7.0474 | 37.2906 | 15.2677 | 32.8980 | All |
|  | | | | | | |
| 2 | 69.9551 | 248.1675 | 62.4012 | 146.6911 | All | 5x5 |
| 3 | 38.8706 | 150.4111 | 38.1971 | 90.4405 | All |
| 4 | 25.3762 | 90.5794 | 28.3952 | 61.4356 | All |
| 5 | 13.8733 | 66.3512 | 21.2462 | 44.4855 | All |
| 6 | 5.9523 | 44.8293 | 15.9709 | 29.7130 | All |
| 7 | 3.4814 | 27.1394 | 11.2712 | 23.4897 | All |

Result of Approach 3

As same as approach 2, but Grid centre has been used as XY coordinate.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of Matched ID out of 7 | Positioning error based on min RSS distance  (in meter) | | Positioning error based on Average of 5 smallest RSS distance\*\*  (in meter) | | Number of matched Testing signature out of 370 | Grid size |
|  | 68% | 95% | 68% | 95% | 388 | mxm |
| 2 | 93.4564 | 329.3509 | 86.2435 | 176.6093 | All | 20 |
| 3 | 59.9512 | 188.5164 | 59.1387 | 110.1151 | All |
| 4 | 45.9047 | 146.8258 | 42.5849 | 84.8010 | All |
| 5 | 33.6291 | 104.5930 | 33.5887 | 65.4325 | All |
| 6 | 21.8756 | 77.1923 | 28.5306 | 48.7839 | All |
| 7 | 13.7219 | 53.5836 | 22.0978 | 36.5139 | All |
|  | | | | | | |
| 2 | 79.2092 | 257.1483 | 73.6500 | 154.0036 | 383 | 10 |
| 3 | 54.2277 | 170.9160 | 49.1497 | 105.4255 | All |
| 4 | 37.9786 | 117.7744 | 35.0697 | 72.9325 | All |
| 5 | 27.4084 | 97.4522 | 27.6360 | 53.0495 | All |
| 6 | 15.5458 | 56.0983 | 21.8133 | 37.7661 | All |
| 7 | 7.4201 | 37.8358 | 15.7964 | 33.0319 | All |
|  | | | | | | |
| 2 | 69.9865 | 248.7751 | 62.8638 | 146.3876 | 378 | 5 |
| 3 | 38.5621 | 150.2832 | 38.0953 | 90.1166 | All |
| 4 | 25.6839 | 90.5923 | 28.5500 | 61.4434 | All |
| 5 | 13.8402 | 64.1030 | 21.3582 | 44.0111 | All |
| 6 | 5.9300 | 45.1615 | 16.0614 | 29.9807 | All |
| 7 | 3.8488 | 26.9729 | 11.5671 | 23.5110 | All |