two_stationary_no_gps Turtlebot 1 Report

Matthew Swartwout

August 10, 2016

This is a summary of the data from the two_stationary_no_gps experiment, Turtlebot #1.

The runtime of this experiment was 0 hours, 0 minutes, and 49.9 seconds.

The total number of external pose measurements recieved by the robot during this time was 0 which means poses were received at an average of 0 poses per second.

Shown below is the summary of each filter's error for both x and y coordinates, and also the error in total distance.

```
summary(continuous$x_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.544e-05 1.412e-04 2.659e-04 2.668e-04 3.927e-04 5.188e-04
```

```
summary(continuous$y_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.078e-09 1.638e-08 3.654e-08 4.321e-08 6.825e-08 1.052e-07
```

```
summary(continuous$yaw_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 9.893e-05 1.317e-04 2.026e-04 2.068e-04 2.840e-04 3.224e-04
```

```
summary(continuous$dist_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.544e-05 1.412e-04 2.659e-04 2.668e-04 3.927e-04 5.188e-04
```

```
summary(discrete$x_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.544e-05 1.412e-04 2.659e-04 2.668e-04 3.927e-04 5.188e-04
```

```
summary(discrete$y_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.078e-09 1.638e-08 3.654e-08 4.321e-08 6.825e-08 1.052e-07
```

```
summary(discrete$yaw_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 9.893e-05 1.317e-04 2.026e-04 2.068e-04 2.840e-04 3.224e-04
```

```
summary(discrete$dist_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.544e-05 1.412e-04 2.659e-04 2.668e-04 3.927e-04 5.188e-04
```

```
summary(noisy_odom$x_err)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 3.780e-05 3.888e-05 4.002e-05 3.983e-05 4.061e-05 4.258e-05
```

```r
summary(noisy_odom$y_err)
```

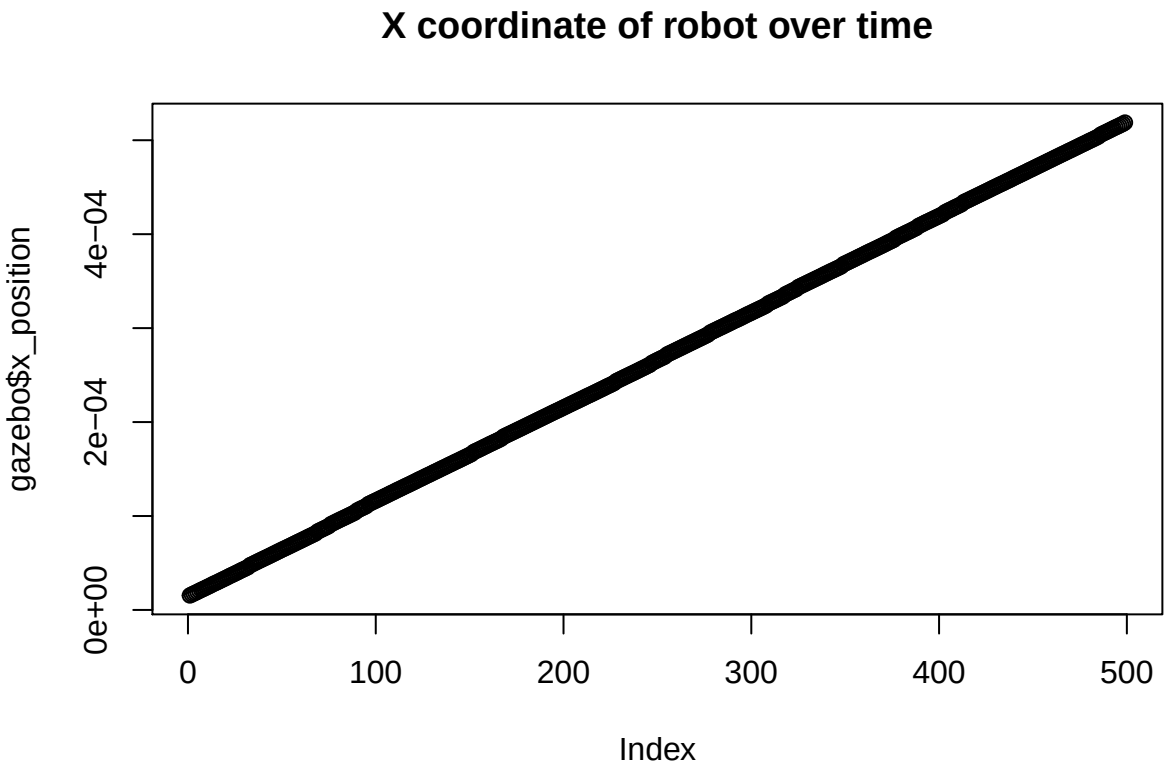
```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -1.185e-07 -1.113e-07 -1.045e-07 -1.047e-07 -9.779e-08 -9.122e-08
```

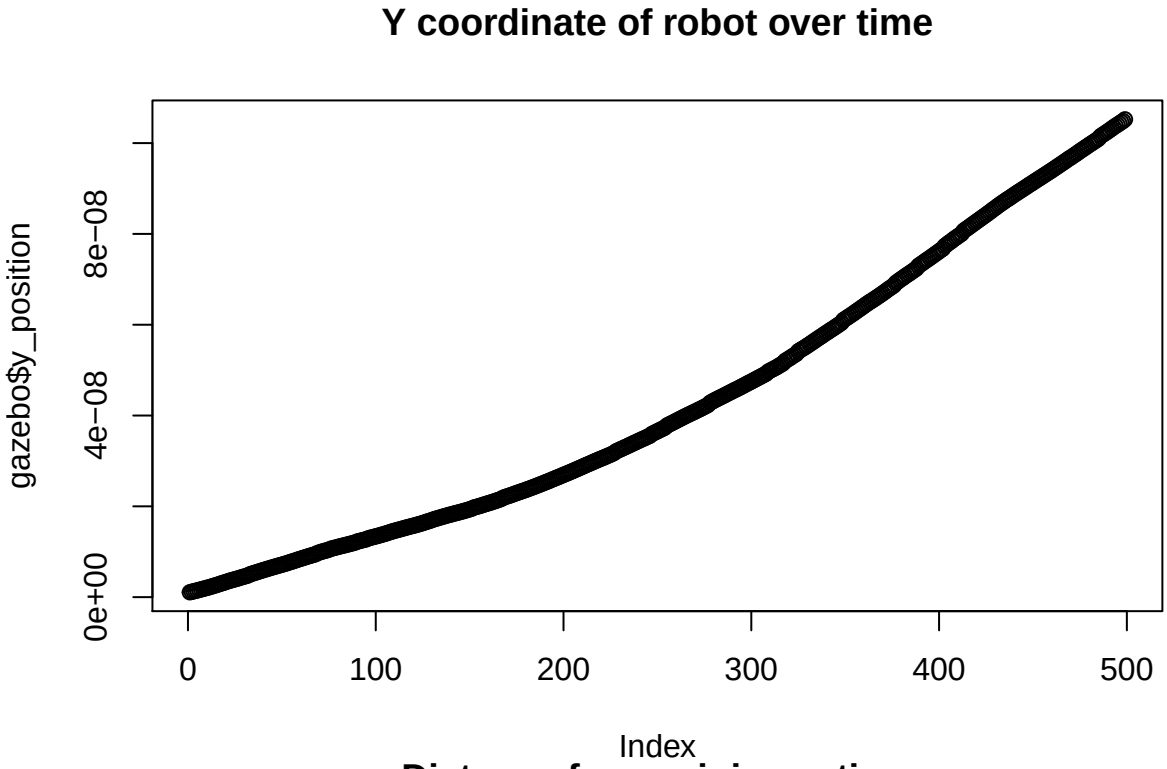
```r
summary(noisy_odom$dist_err)
```

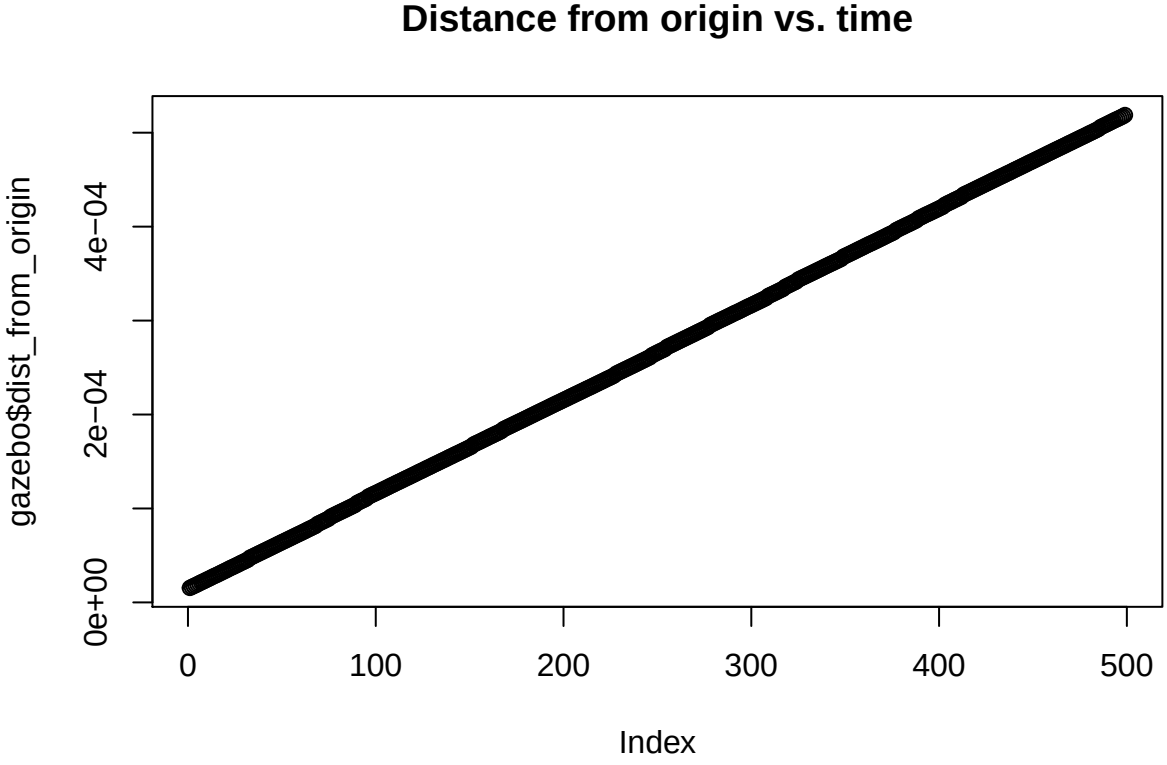
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 3.780e-05 3.888e-05 4.002e-05 3.983e-05 4.061e-05 4.258e-05
```

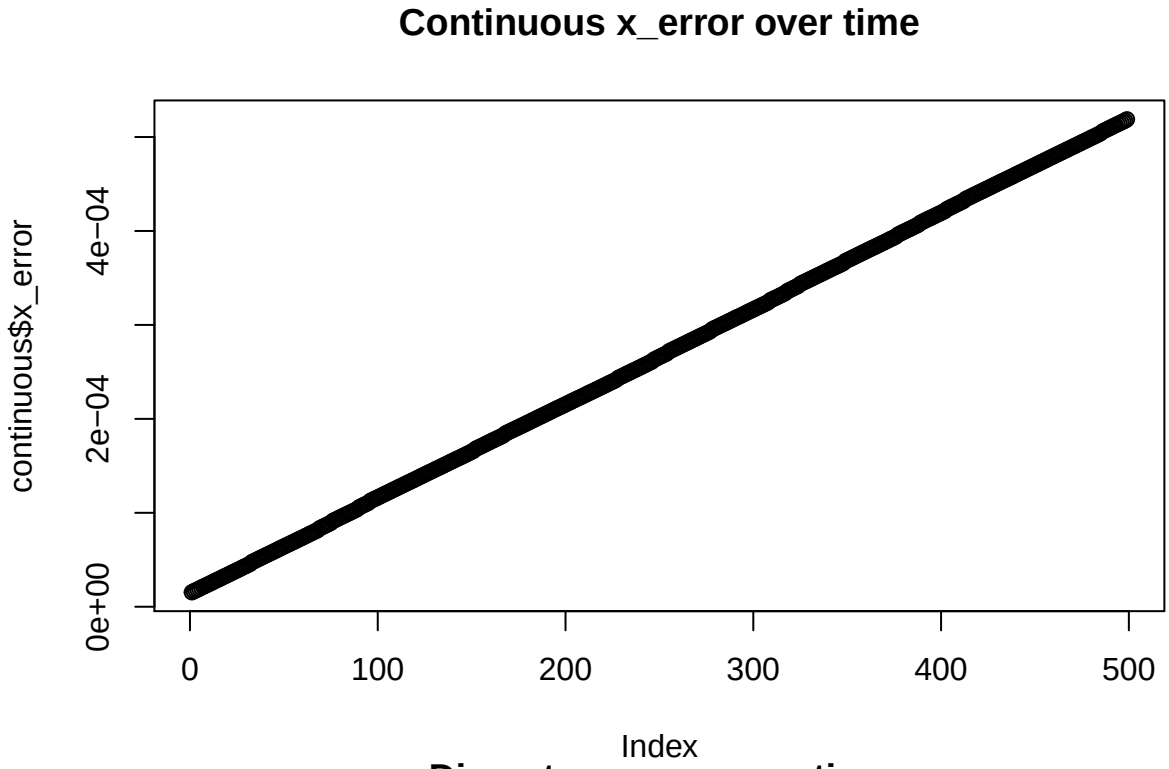
```r
if (NROW(gps) > 0) {
    summary(gps$x_err)
    summary(gps$y_err)
    summary(gps$dist_err)
}

if (NROW(noisy_odom) > 0) {
    summary(noisy_odom$x_variance)
    summary(noisy_odom$y_variance)
    summary(noisy_odom$yaw_variance)
}
```

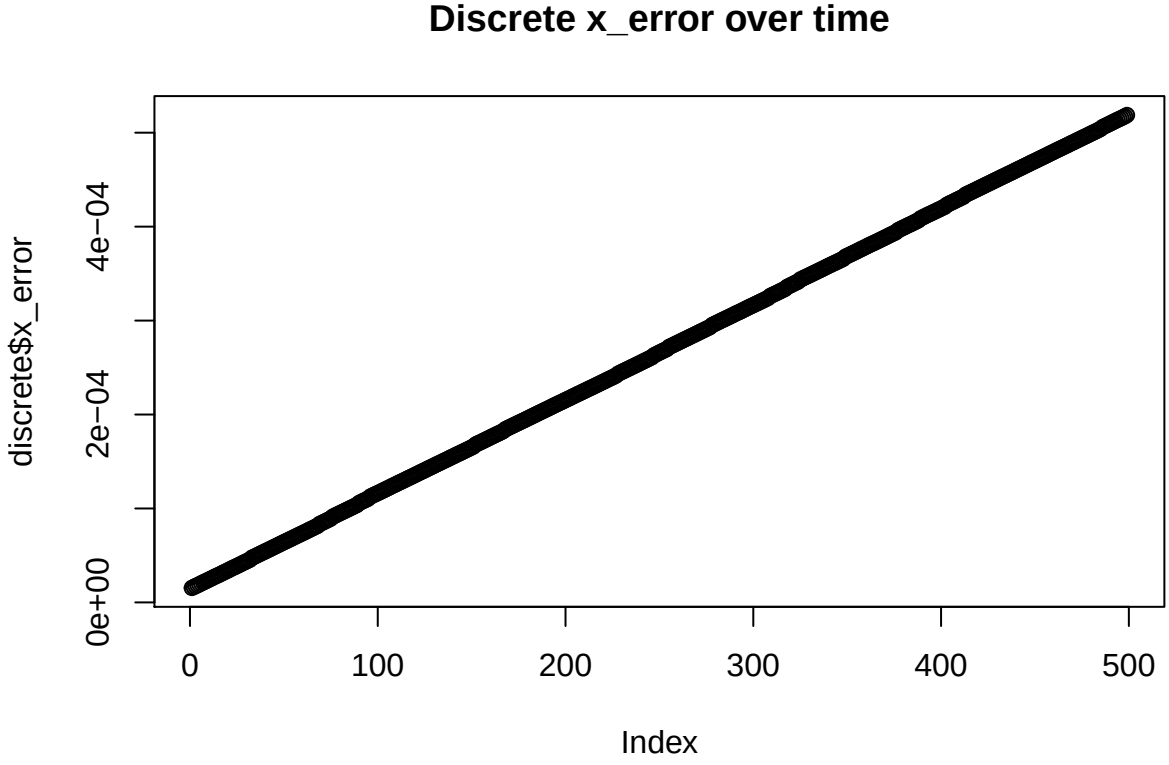
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 9.225e-16 7.684e-15 1.695e-14 2.210e-14 2.965e-14 1.569e-13
```

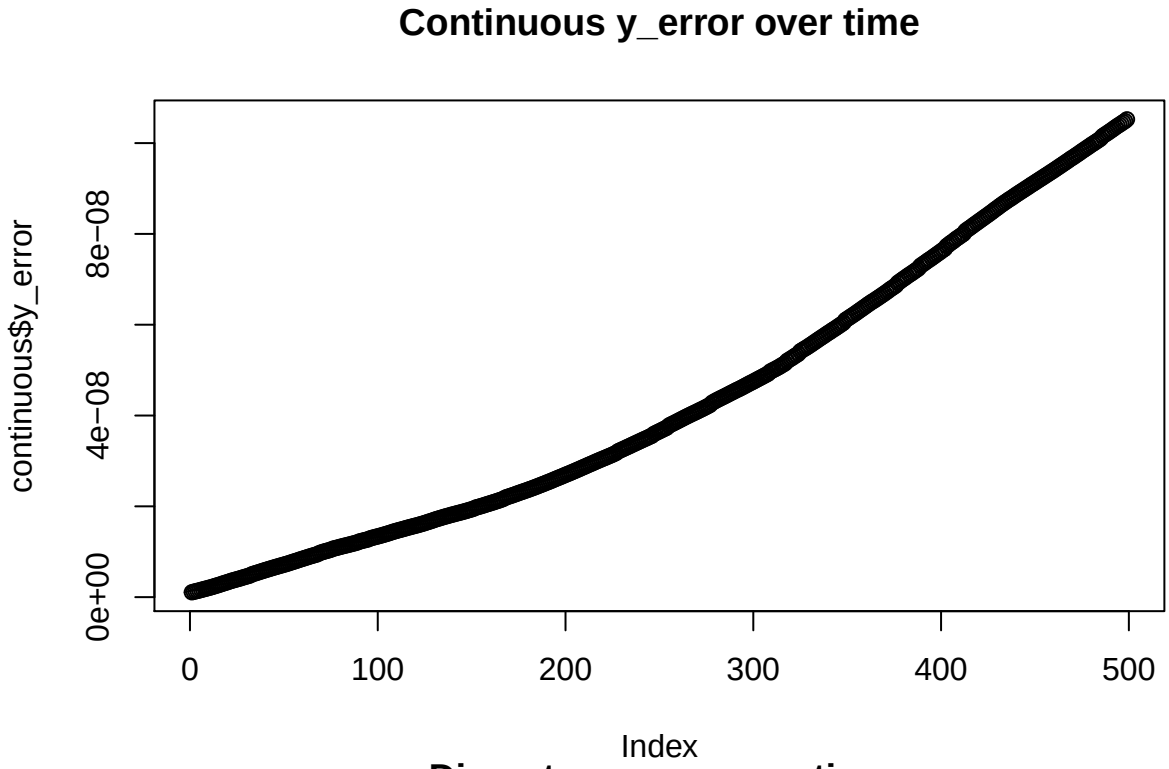


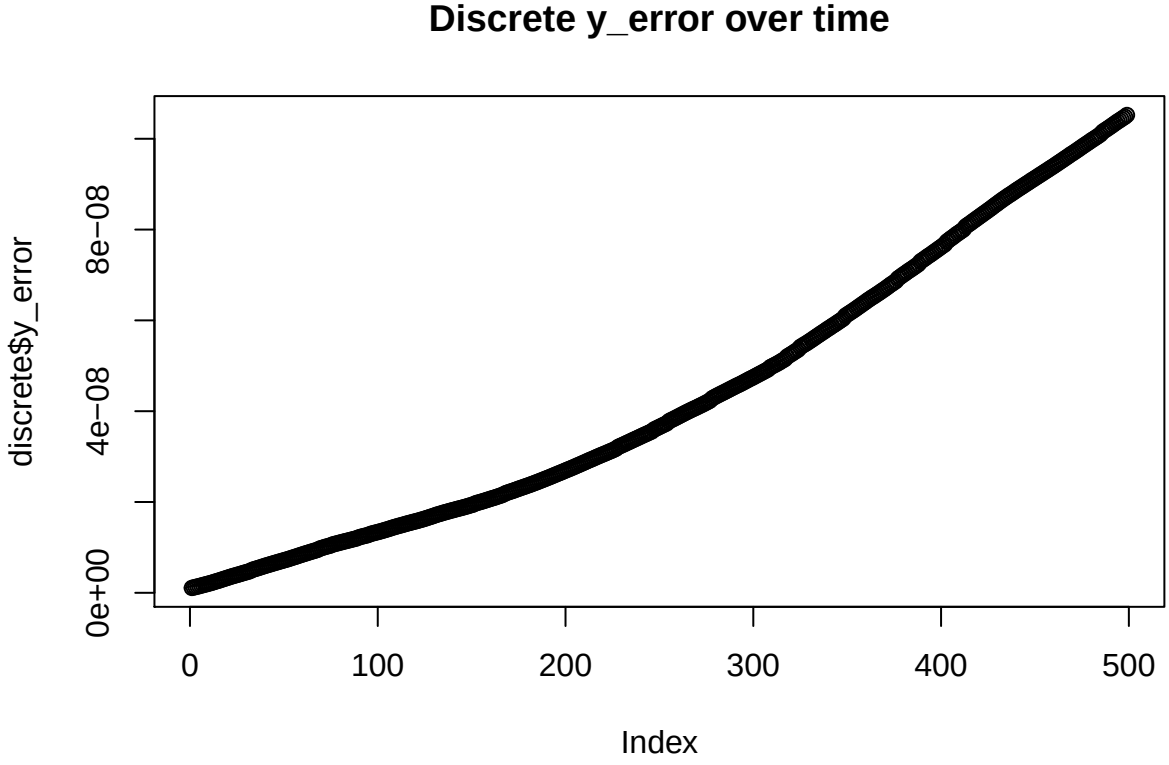

Y coordinate of robot over time
gazebo$y_position
0e+00
4e−08
8e−08
0
100
200
300
400
500
Index

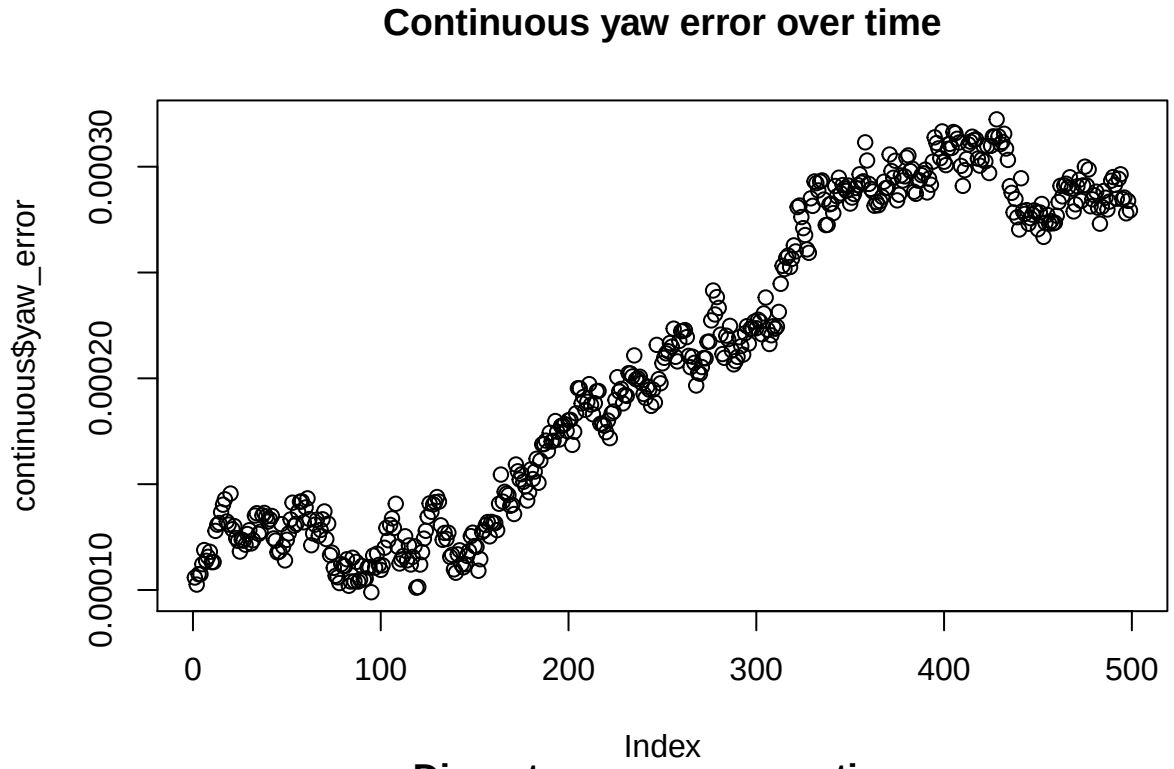

Distance from origin vs. time
gazebo$dist_from_origin
0e+00
2e−04
4e−04
0
100
200
300
400
500
Index

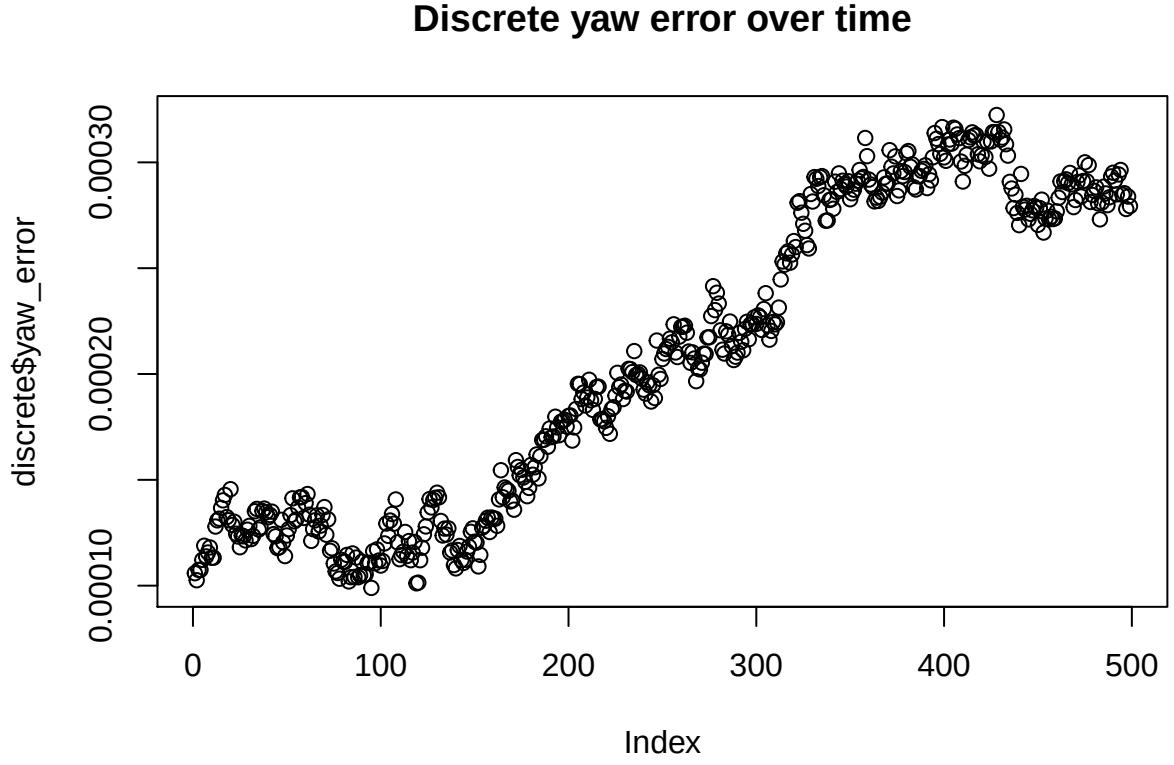

Continuous x_error over time
continuous$x_error
0e+00
2e−04
4e−04
0
100
200
300
400
500
Index

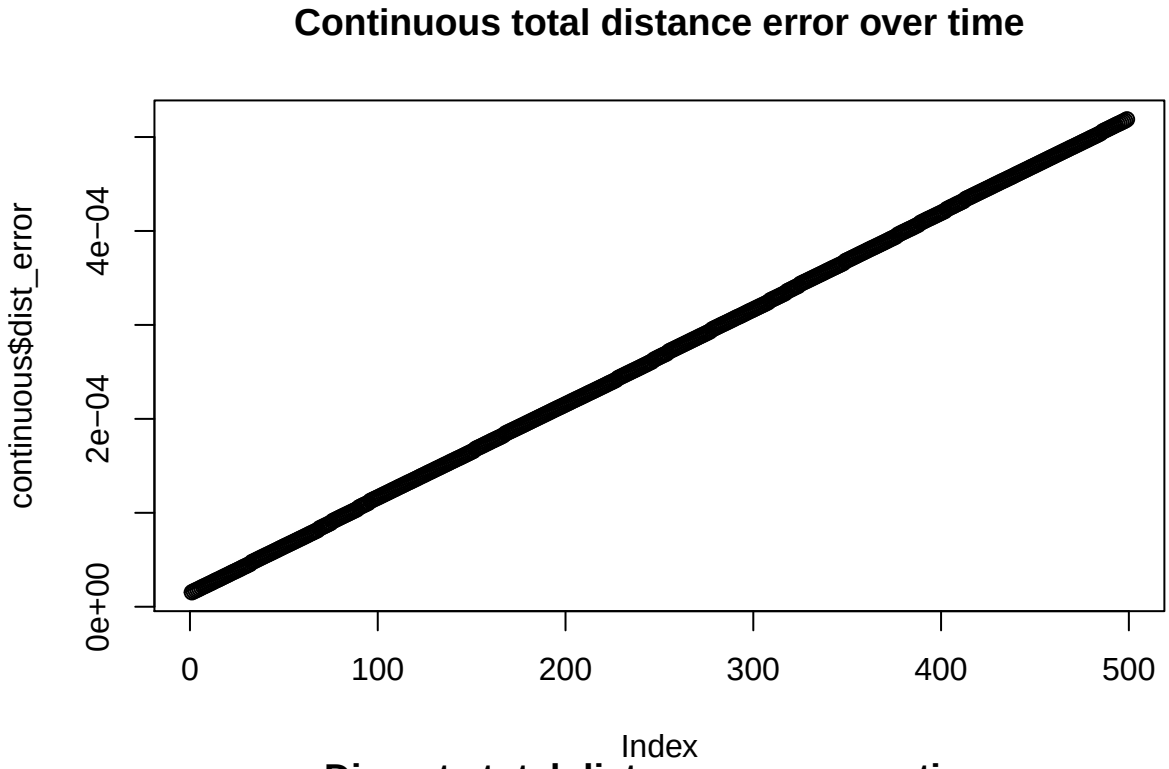

Discrete x_error over time
discrete$x_error
0e+00
2e−04
4e−04
0
100
200
300
400
500
Index

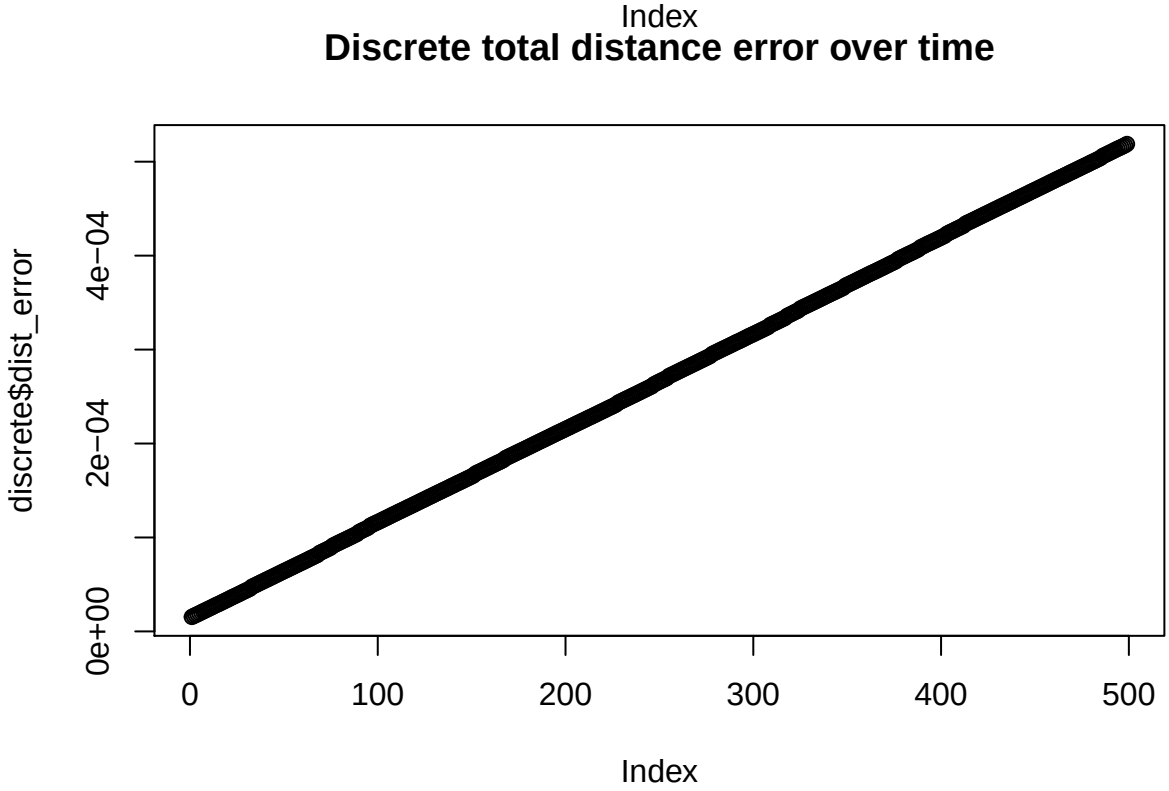

Continuous y_error over time
continuous$y_error
0e+00
4e−08
8e−08
0
100
200
300
400
500
Index

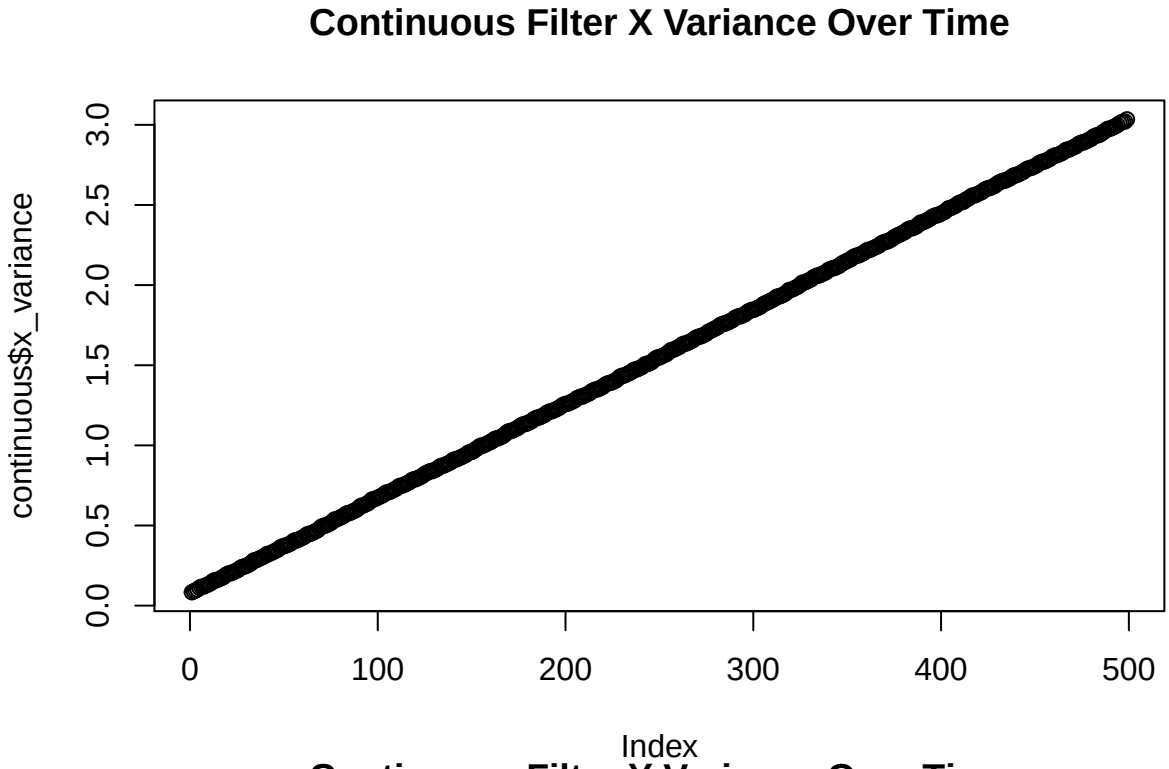

Discrete y_error over time
discrete$y_error
0e+00
4e−08
8e−08
0
100
200
300
400
500
Index

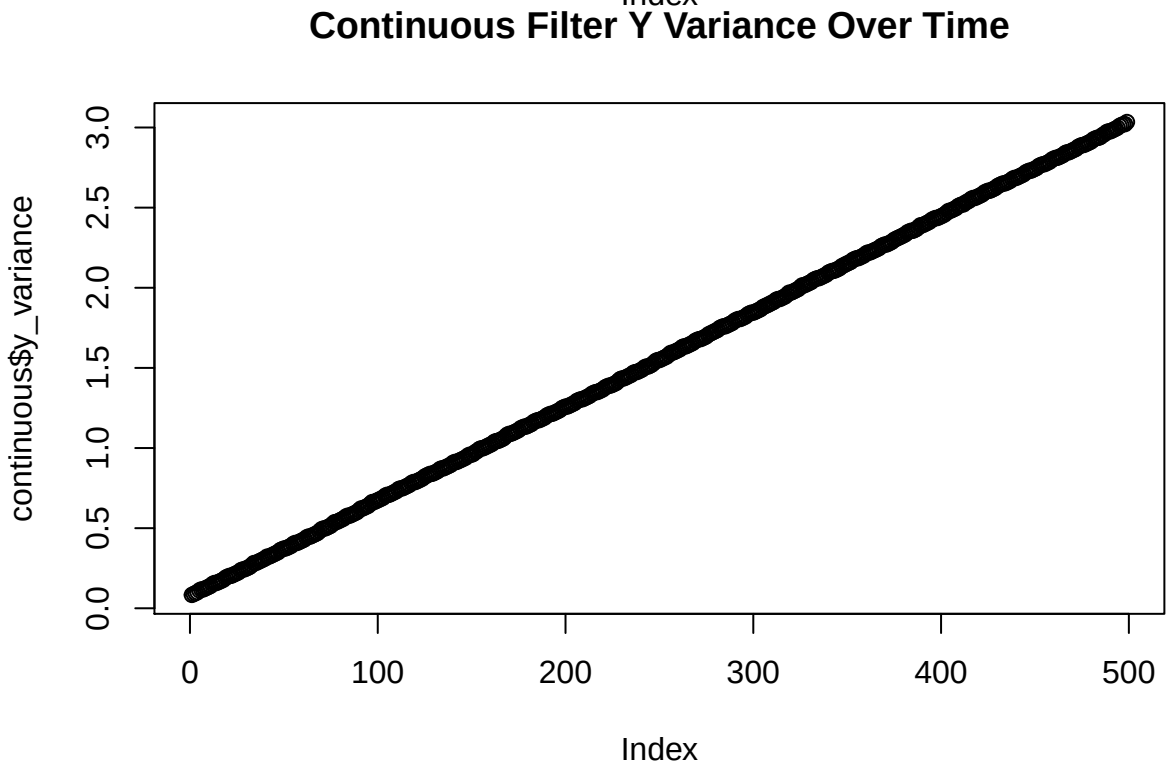

Continuous yaw error over time
continuous$yaw_error
0.00010
0.00020
0.00030
0
100
200
300
400
500
Index

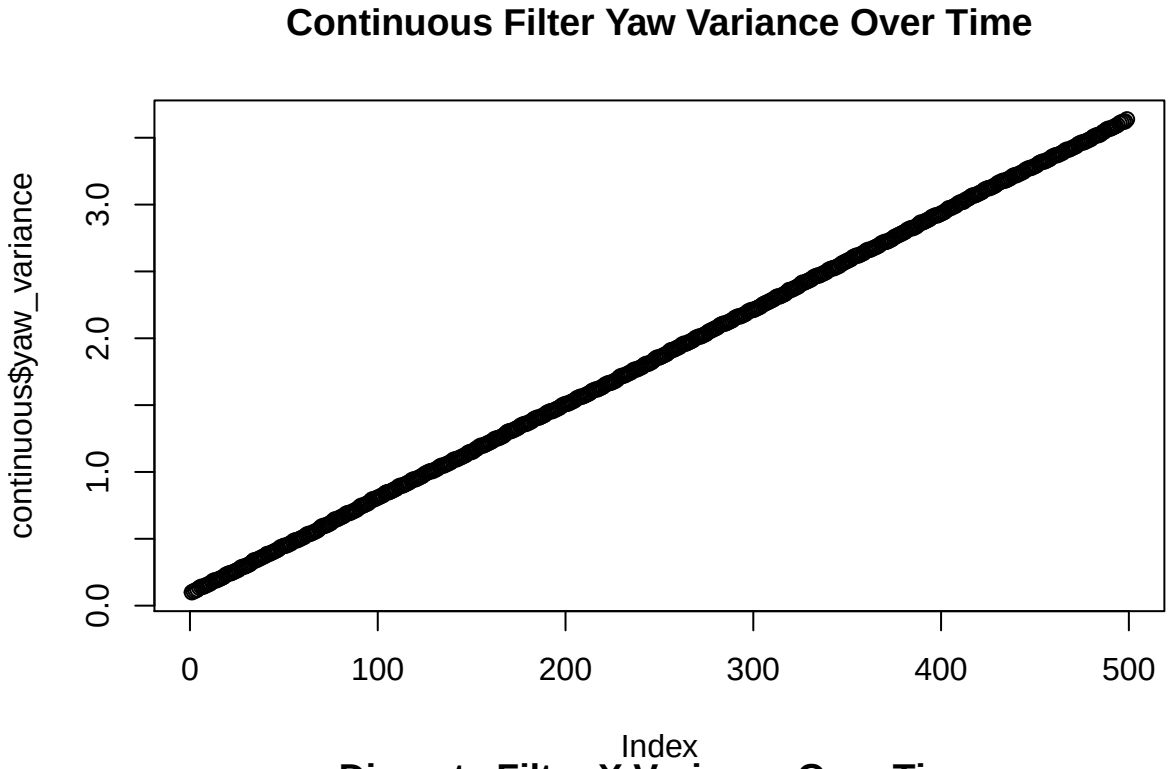

Discrete yaw error over time
discrete$yaw_error
0.00010
0.00020
0.00030
0
100
200
300
400
500
Index

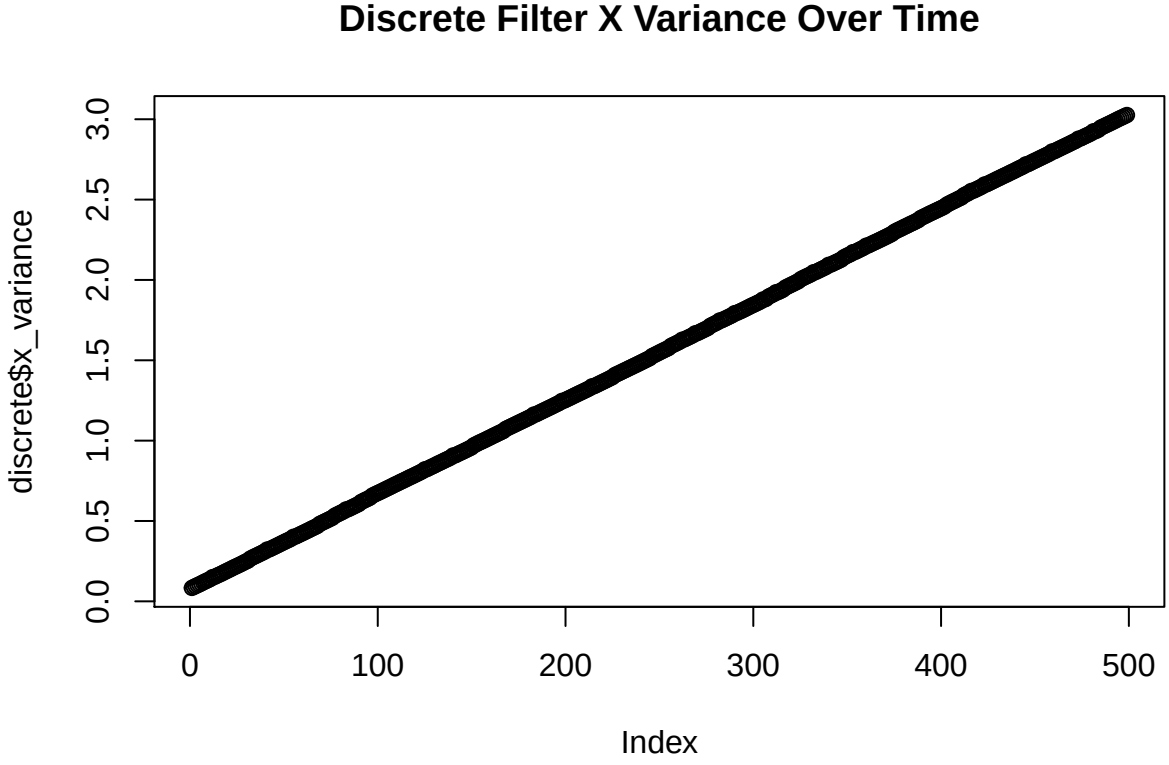

Continuous total distance error over time
continuous$dist_error
0e+00
2e−04
4e−04
0
100
200
300
400
500
Index

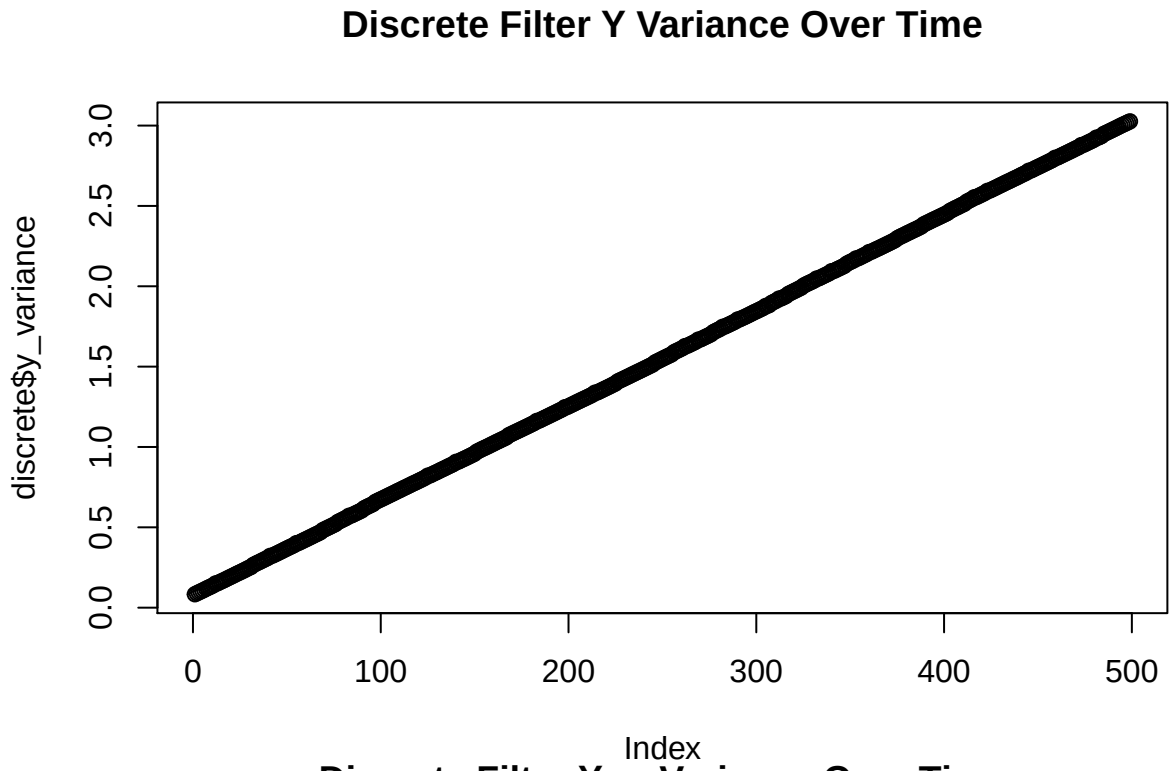

Discrete total distance error over time
discrete$dist_error
0e+00
2e−04
4e−04
0
100
200
300
400
500
Index

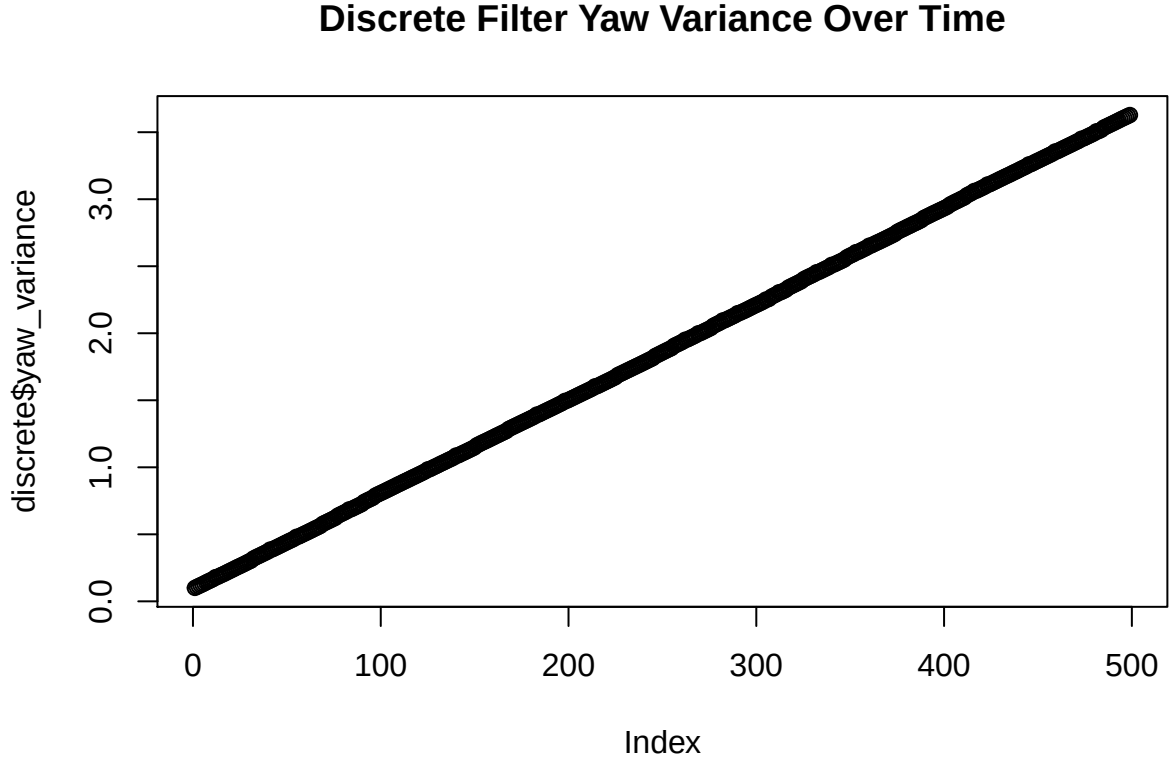

Continuous Filter X Variance Over Time
continuous$x_variance
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
100
200
300
400
500
Index

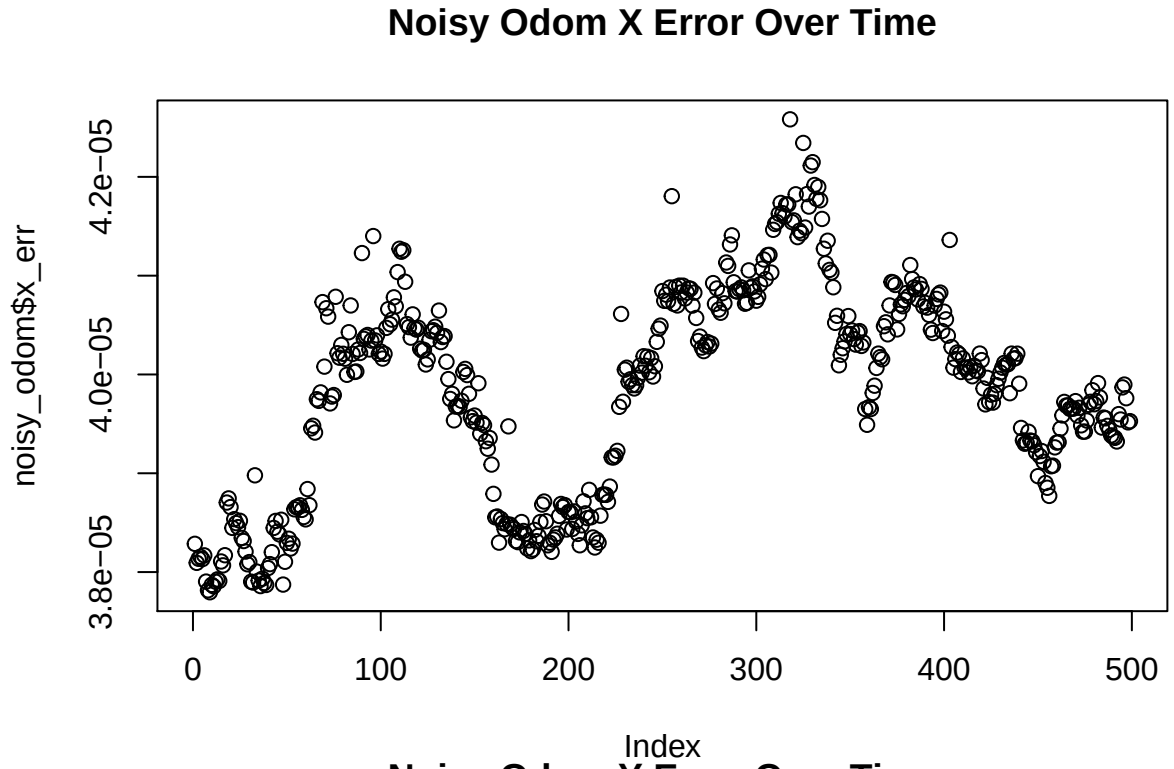

Continuous Filter Y Variance Over Time
continuous$y_variance
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
100
200
300
400
500
Index

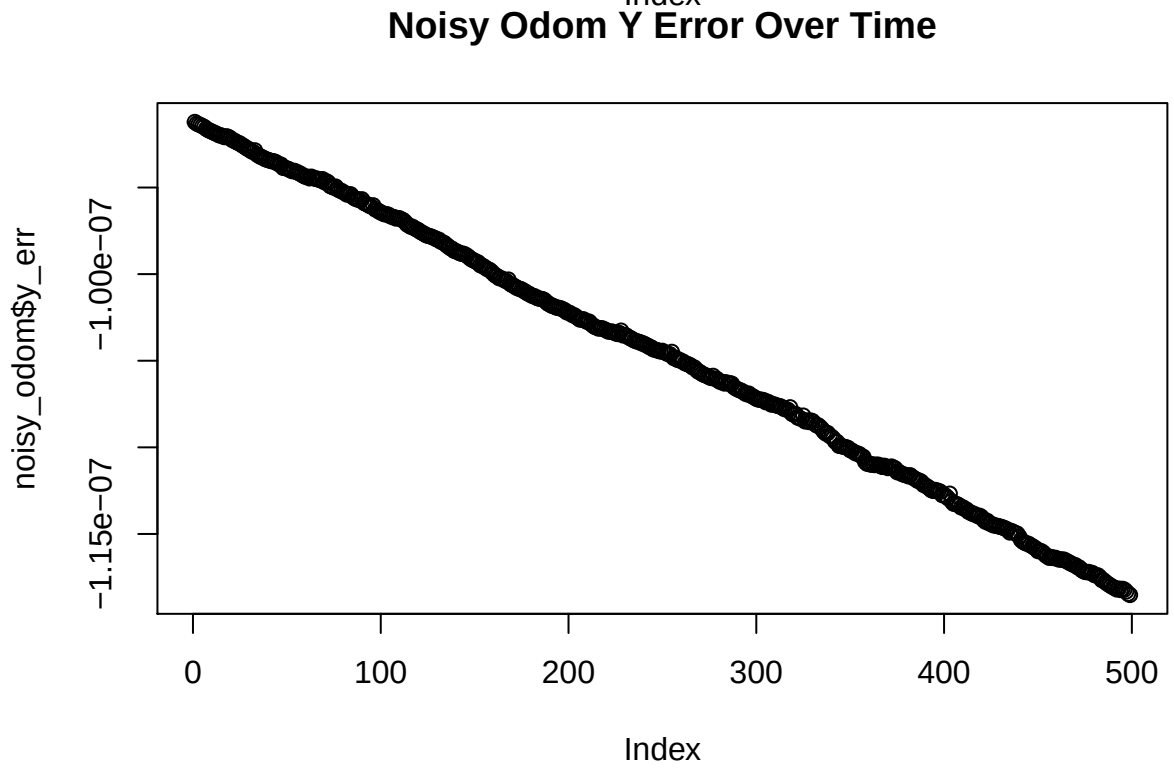

Continuous Filter Yaw Variance Over Time
continuous$yaw_variance
0.0
1.0
2.0
3.0
0
100
200
300
400
500
Index

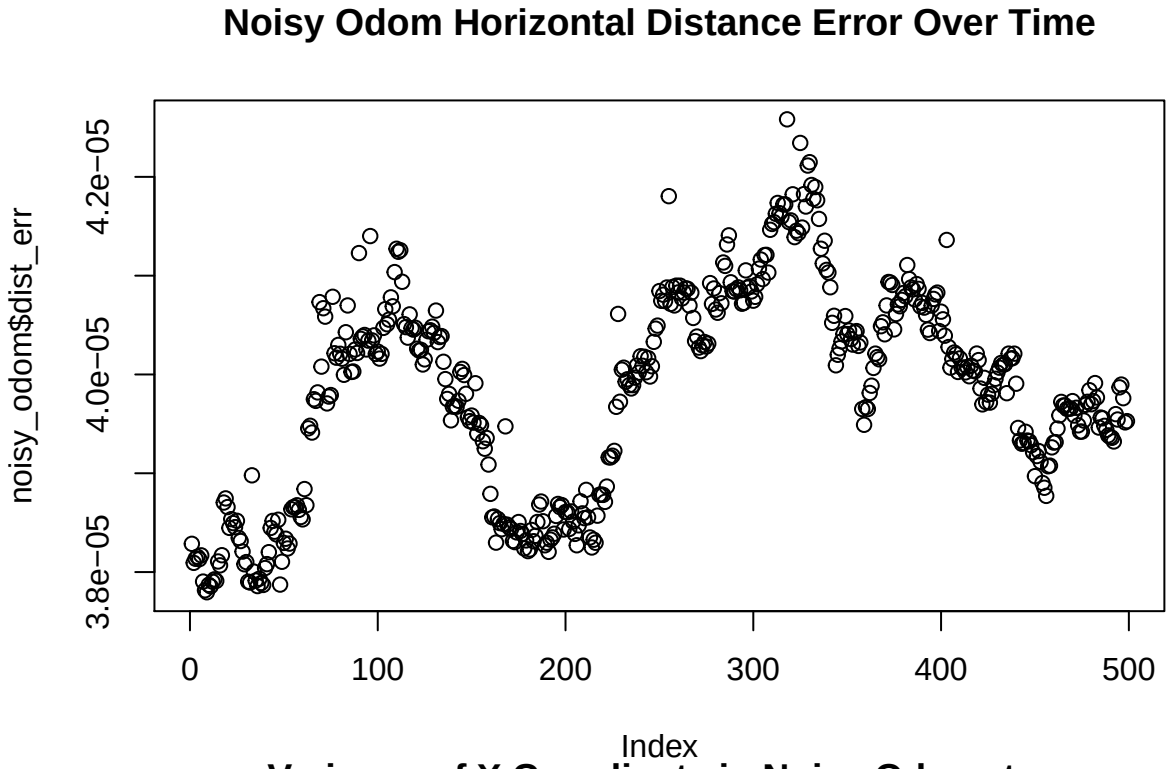

Discrete Filter X Variance Over Time
discrete$x_variance
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
100
200
300
400
500
Index

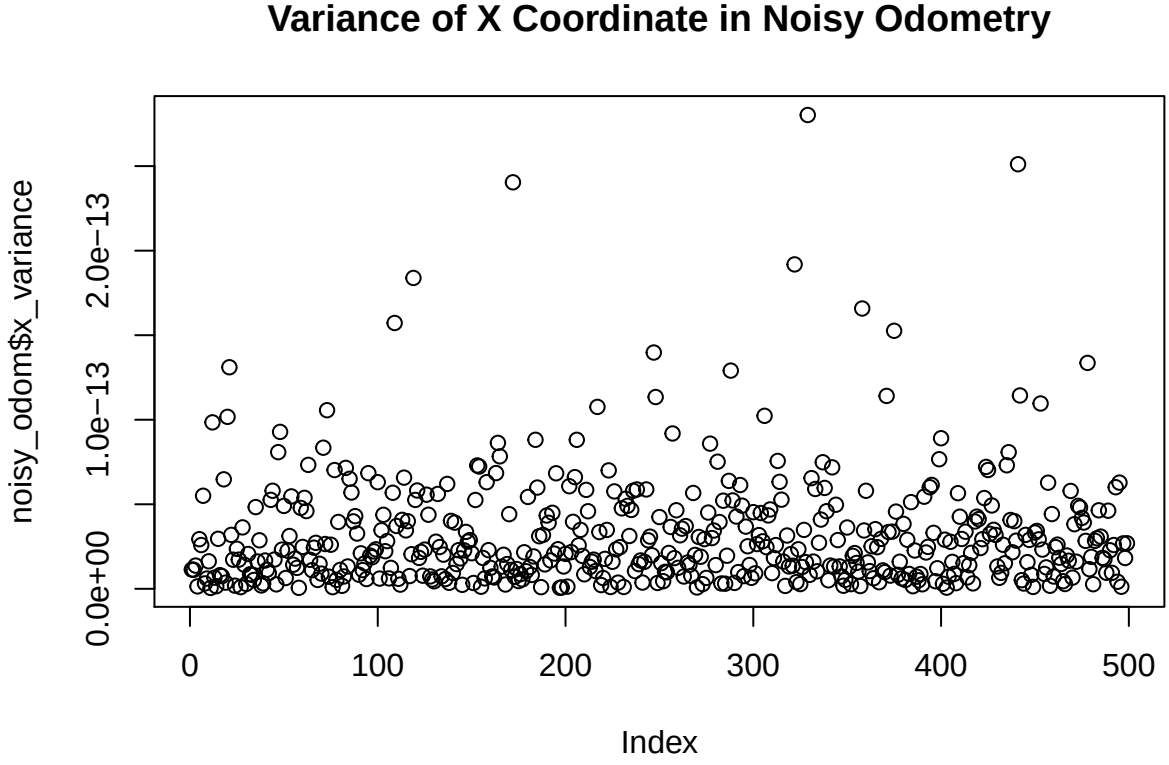

Discrete Filter Y Variance Over Time
discrete$y_variance
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
100
200
300
400
500
Index

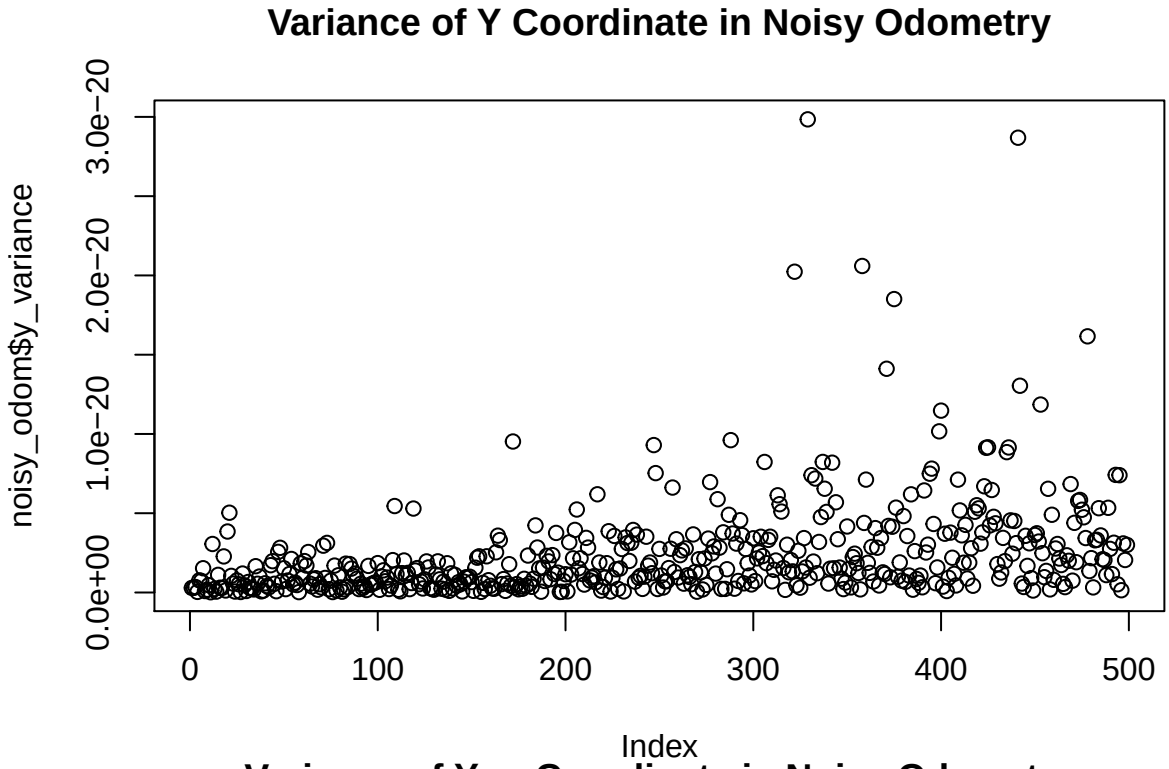

Discrete Filter Yaw Variance Over Time
discrete$yaw_variance
0.0
1.0
2.0
3.0
0
100
200
300
400
500
Index

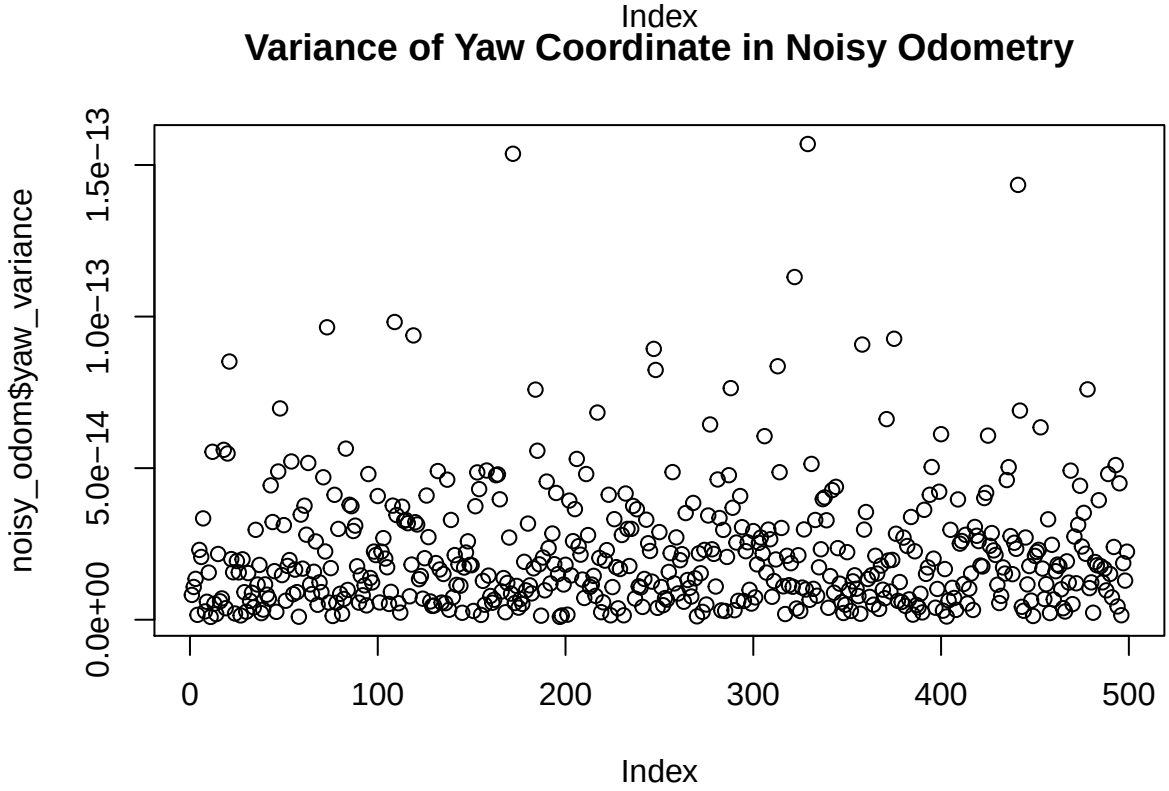

Noisy Odom X Error Over Time
noisy_odom$x_err
3.8e−05
4.0e−05
4.2e−05
0
100
200
300
400
500
Index

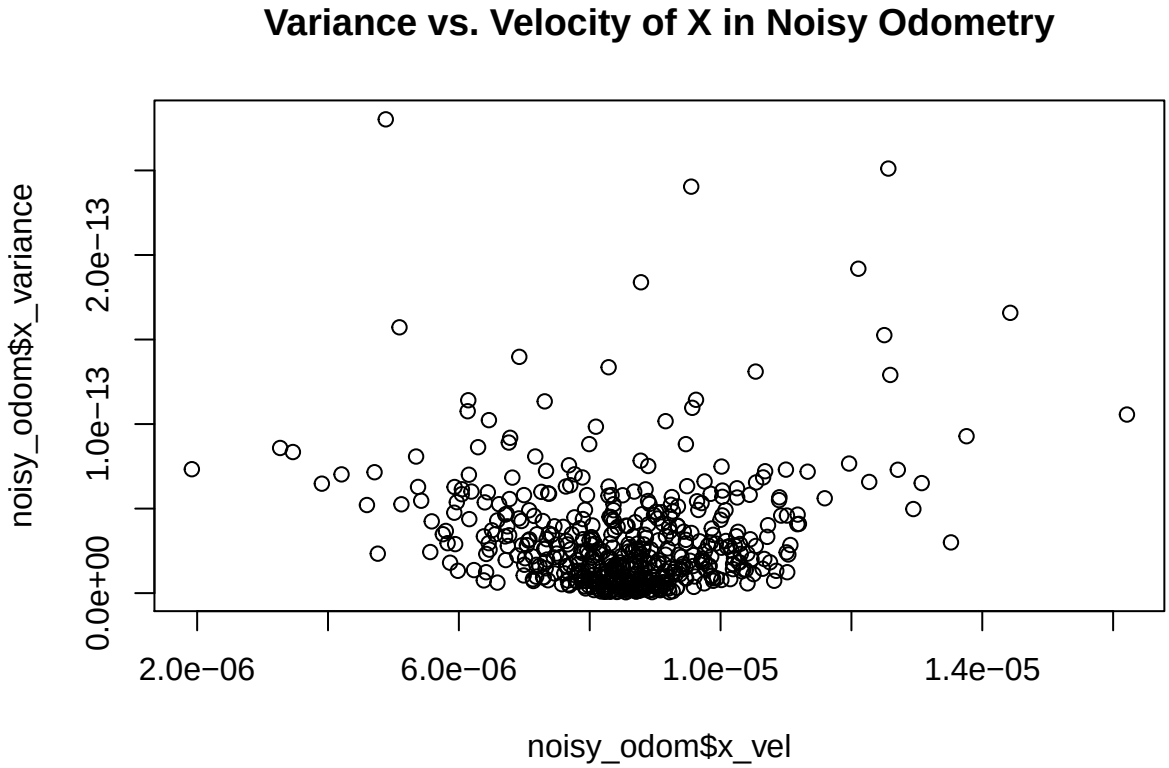

Noisy Odom Y Error Over Time
noisy_odom$y_err
−1.15e−07
−1.00e−07
0
100
200
300
400
500
Index

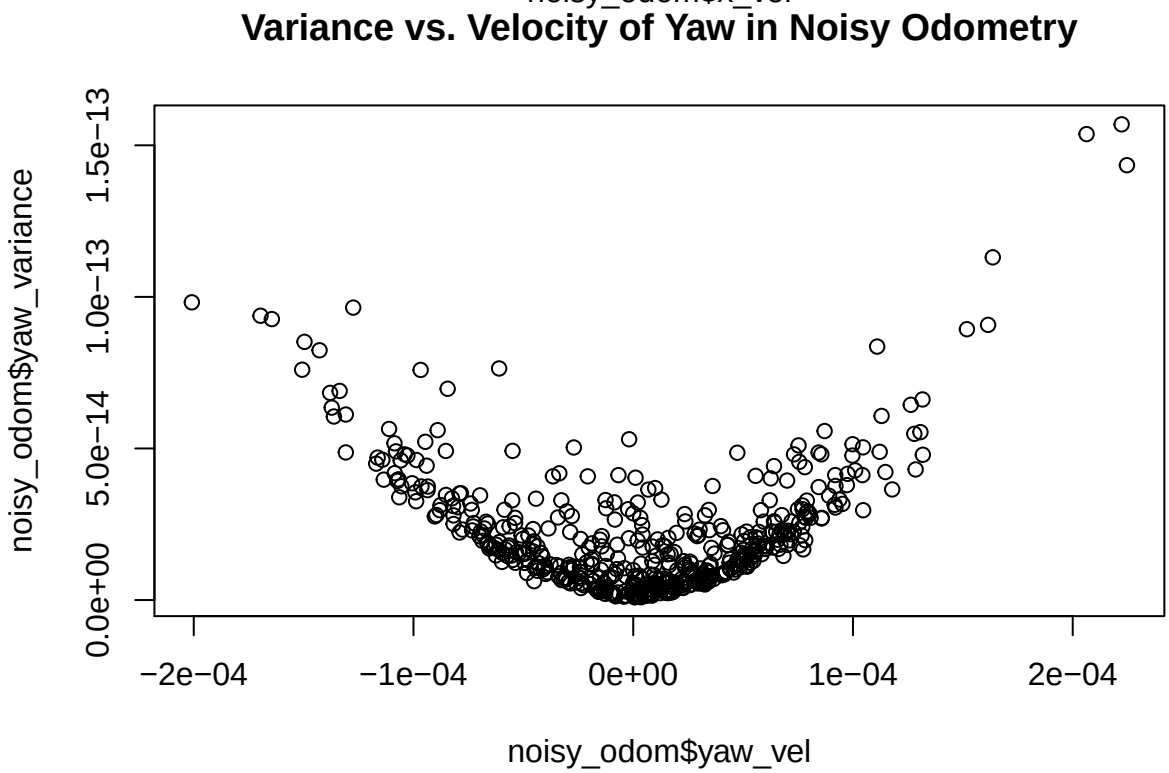

Noisy Odom Horizontal Distance Error Over Time
noisy_odom$dist_err
3.8e−05
4.0e−05
4.2e−05
0
100
200
300
400
500
Index


Variance of X Coordinate in Noisy Odometry
noisy_odom$x_variance
0.0e+00
1.0e−13
2.0e−13
0
100
200
300
400
500
Index


Variance of Y Coordinate in Noisy Odometry
noisy_odom$y_variance
0.0e+00
1.0e−20
2.0e−20
3.0e−20
0
100
200
300
400
500
Index


Variance of Yaw Coordinate in Noisy Odometry
noisy_odom$yaw_variance
0.0e+00
5.0e−14
1.0e−13
1.5e−13
0
100
200
300
400
500
Index


Variance vs. Velocity of X in Noisy Odometry
noisy_odom$x_variance
0.0e+00
1.0e−13
2.0e−13
2.0e−06
6.0e−06
1.0e−05
1.4e−05
noisy_odom$x_vel


Variance vs. Velocity of Yaw in Noisy Odometry
noisy_odom$yaw_variance
0.0e+00
5.0e−14
1.0e−13
1.5e−13
−2e−04
−1e−04
0e+00
1e−04
2e−04
noisy_odom$yaw_vel