two_mobile_noiseless_no_gps Experiment Report

Matthew Swartwout

August 10, 2016

This is a summary of the data from the two_mobile_noiseless_no_gps experiment.

Shown below is the summary of the error of all robots combined 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.
## -1.0920000 -1.0920000 -0.0000402 -0.5320000  0.0001269  0.0054550
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -0.7268000 -0.7264000 -0.0004404 -0.3574000 -0.0001707  0.0000737
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -3.1380 -1.3750 -0.9165  0.4160  2.4270  3.1020
```

```
summary(continuous$horizontal_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.0000144 0.0002740 0.0005225 0.6413000 1.3110000 1.3120000
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -28.970 -23.060 -16.660 -17.570 -12.610   0.187
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  -9.687   1.274  37.130  32.410  58.780  96.780
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -3.1400 -1.3460 -0.9162  0.4473  2.4880  3.1000
```

```
summary(discrete$horizontal_error)
```

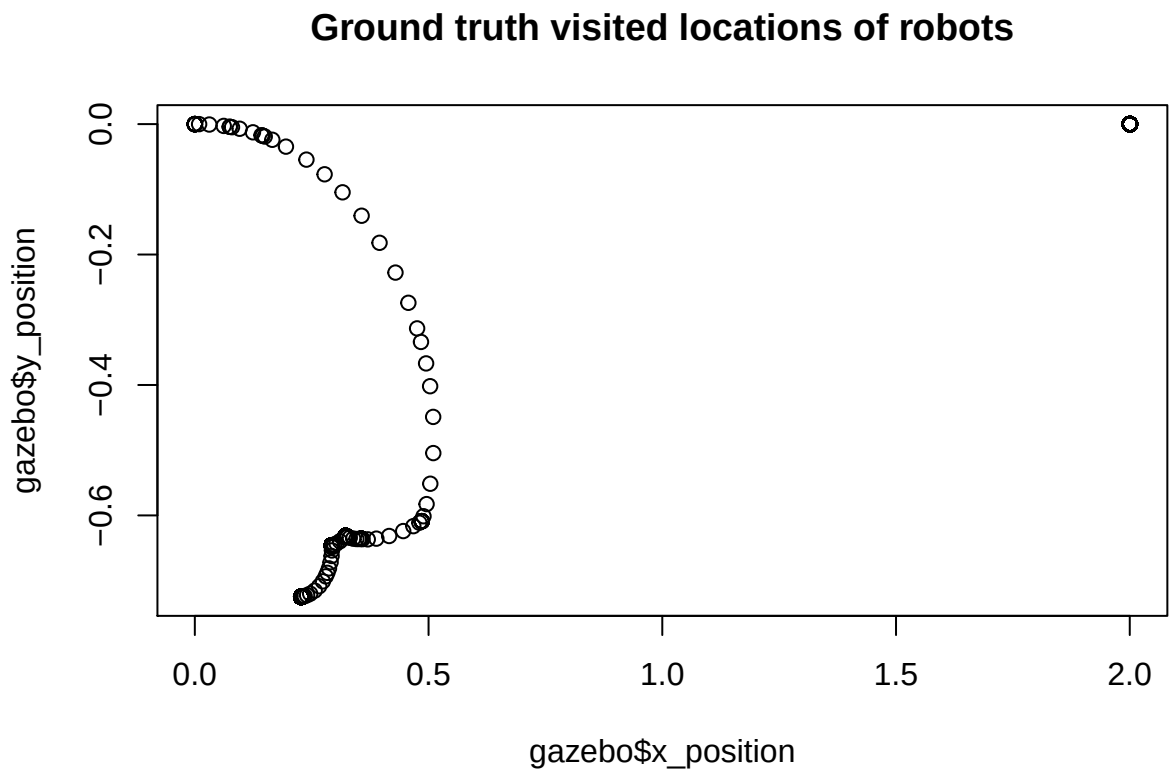
```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##  0.00001 27.14000 40.69000 42.64000 60.08000 96.91000
```

```
if (params$robot >= 2) {
    summary(external_data_averages)
}
```

```
##      Length Class  Mode
## [1,] 1      -none- numeric
## [2,] 1      -none- numeric
```

Shown below are plots representing the robot's motion and error over time.

```r
plot(gazebo$x_position, gazebo$y_position,
     main = "Ground truth visited locations of robots")
```

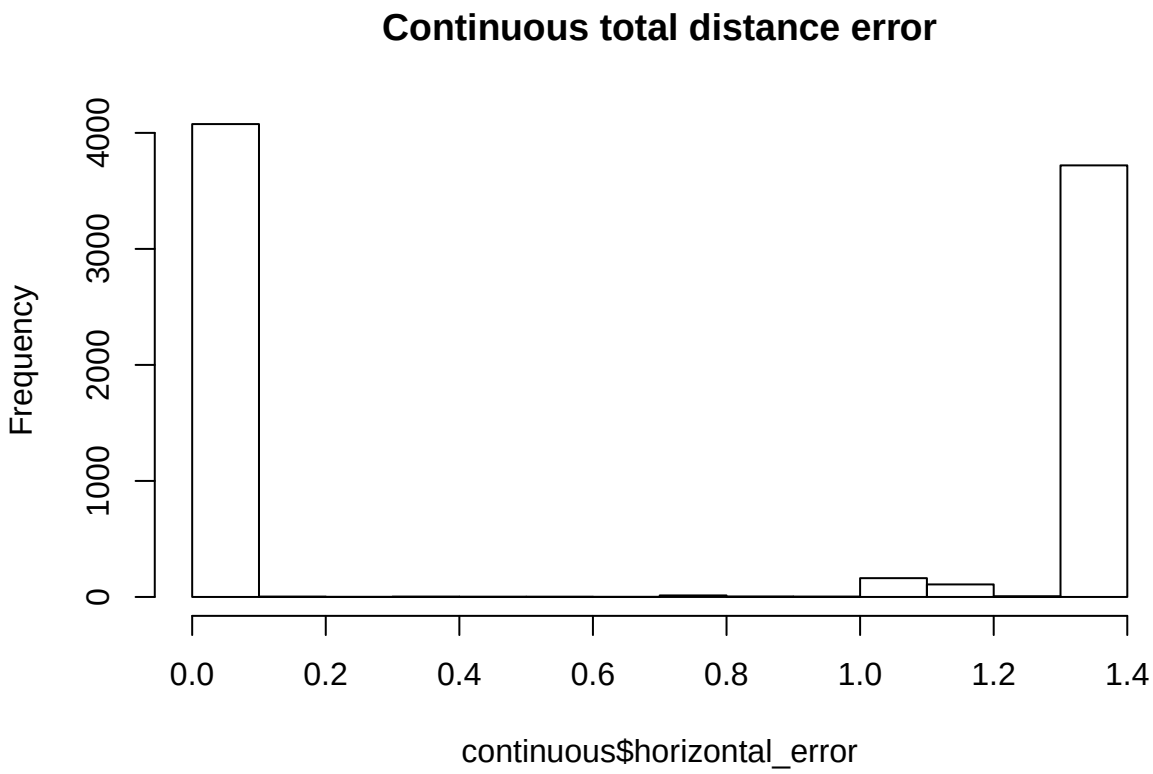



```r
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```

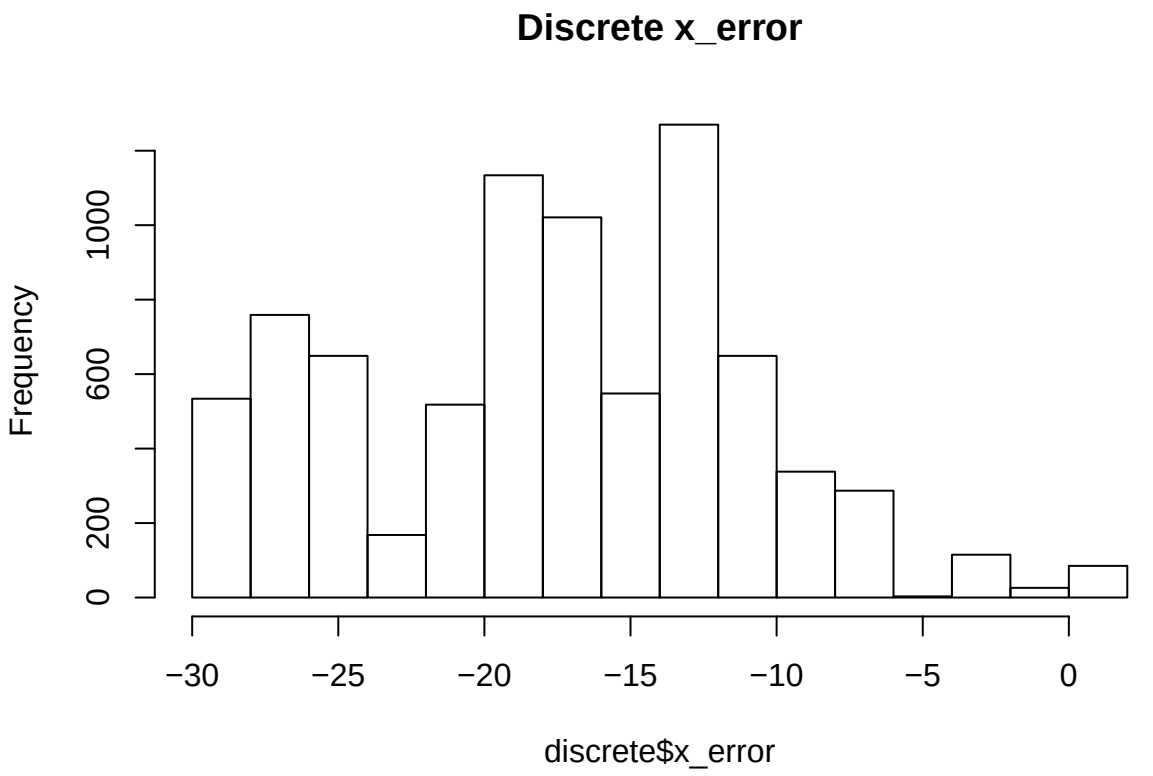
```r
hist(continuous$x_error,
     main = "Continuous x_error")
```


```r
hist(continuous$y_error,
      main = "Continuous y_error")
```

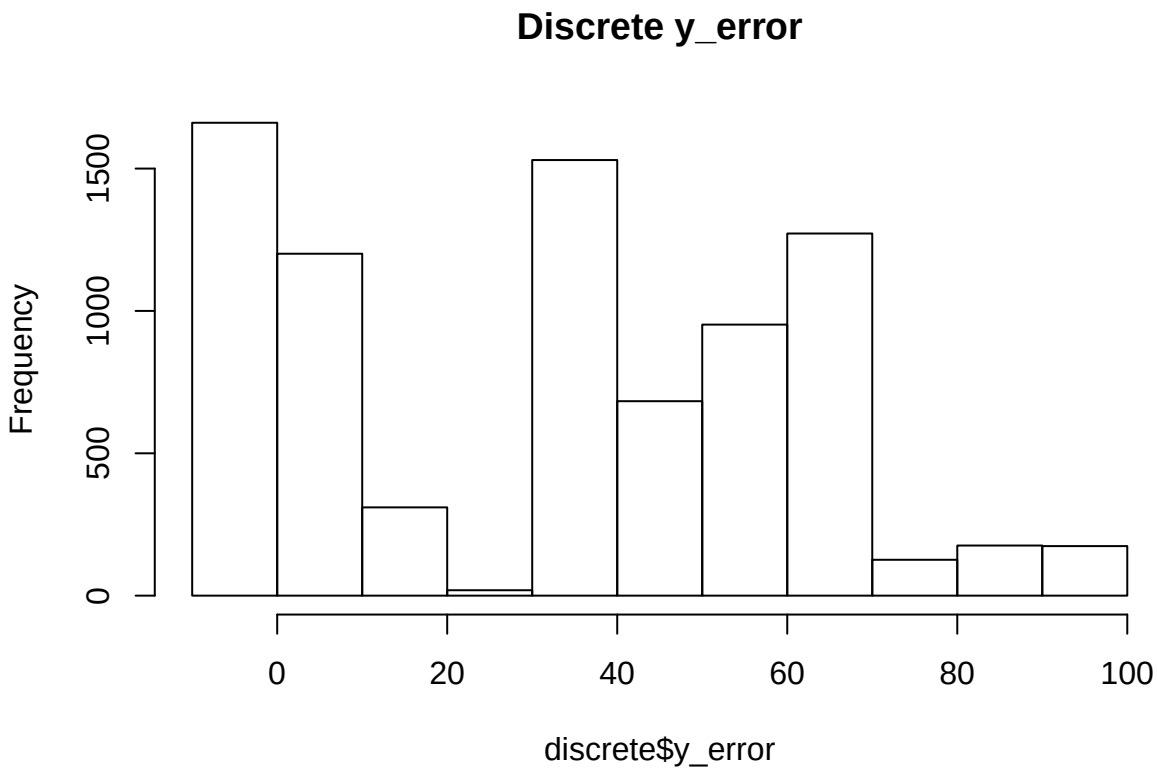
```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



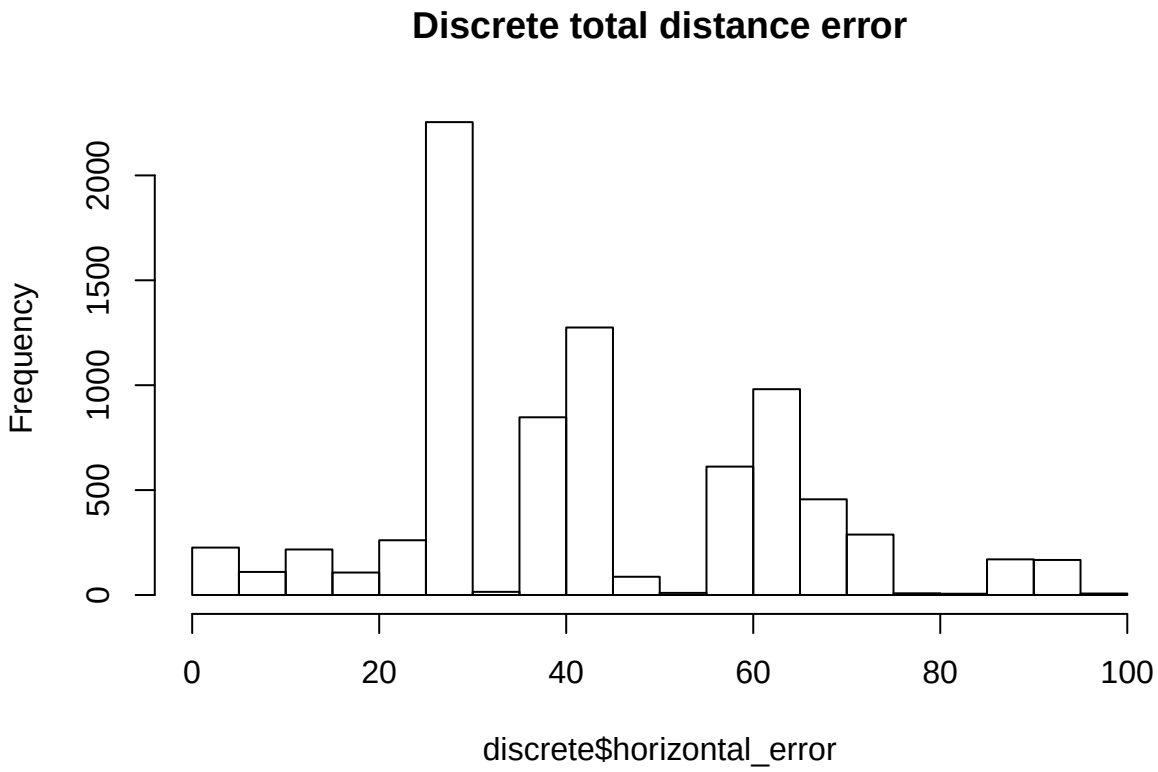

```r
hist(discrete$x_error,
     main = "Discrete x_error")
```



```r
hist(discrete$y_error,
     main = "Discrete y_error")
```




```r
hist (discrete$horizontal_error,
      main = "Discrete total distance error")
```



```
figure_dir <- "/home/matt/thesis/writing/r_figures/"
filename = paste0(figure_dir, params$experiment, "_continuous_error.pdf")
pdf(filename)
plot(continuous$horizontal_error, main="Continuous Filter Error", sub=paste0("For ", params$experiment,

dev.off()
```

```
## pdf
##   2
```

```
filename = paste0(figure_dir, params$experiment, "_discrete_error.pdf")
pdf(filename)
plot(discrete$horizontal_error, main="Discrete Filter Error", sub=paste0("For ", params$experiment, " E
dev.off()
```

```
## pdf
##   2
```

```
if (params$experiment == "one_stationary_noiseless") {
    gazebo$horizontal_error <- sqrt(gazebo$x_position ^ 2 + gazebo$y_position ^ 2)
    pdf(paste0(figure_dir, "gazebo_odom_drift.pdf"))

    plot(gazebo$horizontal_error, main="Gazebo Odometry Drift for Stationary Robot with Noiseless Odome
    dev.off()
}
```

```
table_dir <- "/home/matt/thesis/writing/autogenerated_tables/"

out_file <- paste0(table_dir, params$experiment, "_continuous_summary.tex")
tex_label <- paste0("tab:", params$experiment, "_continuous_summary")
stargazer(continuous,
          out=out_file,
          table.placement="h",
          label=tex_label,
          title=gsub("_", "-", paste0("Continuous Filter Estimate for ", params$experiment, " Experimen
          digits.extra = 20)
```

```
##
## % Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvar
## % Date and time: Wed, Aug 10, 2016 - 04:40:00 PM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for two-mobile-noiseless-no-gps Experiment}
##   \label{tab:two_mobile_noiseless_no_gps_continuous_summary}
## \begin{tabular}{@{\extracolsep{5pt}}lccccc}
## \\[-1.8ex]\hline
## \hline \\[-1.8ex]
## Statistic & \multicolumn{1}{c}{N} & \multicolumn{1}{c}{Mean} & \multicolumn{1}{c}{St. Dev.} & \multi
## \hline \\[-1.8ex]
## x\_position & 8,104 & 1.649 & 0.361 & $-$0.000 & 2.000 \\
## y\_position & 8,104 & 0.001 & 0.001 & $-$0.000 & 0.002 \\
## yaw & 8,104 & 0.189 & 1.668 & $-$3.140 & 3.139 \\
## x\_variance & 8,104 & 12.041 & 6.916 & 0.080 & 24.040 \\
## y\_variance & 8,104 & 12.041 & 6.916 & 0.080 & 24.040 \\
## yaw\_variance & 8,104 & 14.435 & 8.291 & 0.095 & 28.821 \\
## yaw\_error & 8,104 & 0.416 & 1.912 & $-$3.138 & 3.102 \\
## x\_error & 8,104 & $-$0.532 & 0.539 & $-$1.092 & 0.005 \\
```

```
## y\_error & 8,104 & $-$0.357 & 0.360 & $-$0.727 & 0.0001 \\
## horizontal\_error & 8,104 & 0.641 & 0.648 & 0.00001 & 1.312 \\
## \hline \\[-1.8ex]
## \end{tabular}
## \end{table}
```

```
out_file <- paste0(table_dir, params$experiment, "_discrete_summary.tex")
tex_label <- paste0("tab:", params$experiment, "_discrete_summary")
stargazer(discrete,
          out=out_file,
          table.placement="h",
          label=tex_label,
          title=gsub("_", "-", paste0("Discrete Filter Estimate for ", params$experiment, " Experiment"
          digits.extra = 20)
```

```
##
## % Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvar
## % Date and time: Wed, Aug 10, 2016 - 04:40:00 PM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for two-mobile-noiseless-no-gps Experiment}
##   \label{tab:two_mobile_noiseless_no_gps_discrete_summary}
## \begin{tabular}{@{\extracolsep{5pt}}lccccc}
## \\[-1.8ex]\hline
## \hline \\[-1.8ex]
## Statistic & \multicolumn{1}{c}{N} & \multicolumn{1}{c}{Mean} & \multicolumn{1}{c}{St. Dev.} & \multi
## \hline \\[-1.8ex]
## x\_position & 8,104 & 18.691 & 6.652 & $-$0.000 & 29.278 \\
## y\_position & 8,104 & $-$32.763 & 28.671 & $-$96.776 & 9.687 \\
## yaw & 8,104 & 0.255 & 1.656 & $-$3.138 & 3.137 \\
## x\_variance & 8,104 & 0.568 & 0.627 & 0.0003 & 3.089 \\
## y\_variance & 8,104 & 0.568 & 0.627 & 0.0003 & 3.089 \\
## yaw\_variance & 8,104 & 14.436 & 8.292 & 0.095 & 28.821 \\
## x\_error & 8,104 & $-$17.574 & 6.750 & $-$28.970 & 0.187 \\
## y\_error & 8,104 & 32.406 & 28.664 & $-$9.687 & 96.776 \\
## horizontal\_error & 8,104 & 42.639 & 20.201 & 0.00001 & 96.911 \\
## yaw\_error & 8,104 & 0.447 & 1.917 & $-$3.140 & 3.100 \\
## \hline \\[-1.8ex]
## \end{tabular}
## \end{table}
```

```
if (params$experiment == "one_stationary_noiseless") {
    stargazer(gazebo,
              out=paste0(table_dir, "gazebo_stationary_noiseless_summary.tex"),
              table.placement="h",
              label="tab:gazebo_stationary_noiseless_summary",
              title="Ground Truth Noiseless Odometry for Stationary Robot located at Origin",
              digits.extra = 20)
}
```