two_mobile_noiseless_no_gps Experiment Report

Matthew Swartwout

August 15, 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.
## -0.68110 -0.12380 -0.02945  0.31970  0.13210  6.07600
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -0.478600 -0.324200 -0.102900  0.840400 -0.000003  7.047000
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -3.1410 -1.2570  0.3905  0.3394  2.3720  3.1350
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.000015 0.153900 0.329100 1.332000 0.499700 9.305000
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -8.7510 -4.2800 -1.6550 -2.7100 -1.1260  0.2002
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -1.030000 -0.002907  0.925000  1.773000  3.079000  7.305000
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -3.1310 -1.4290  0.3832  0.3319  2.3730  3.1390
```

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

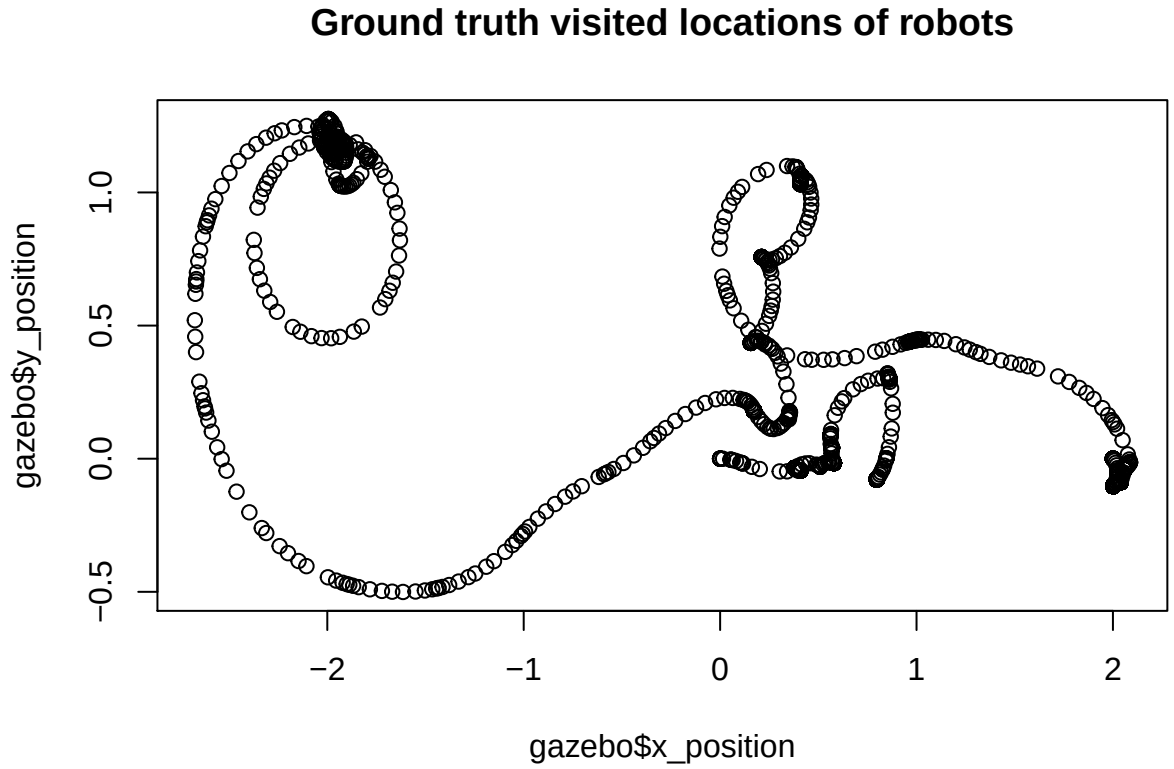
```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.000015 1.367000 1.786000 3.573000 5.833000 9.131000
```

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

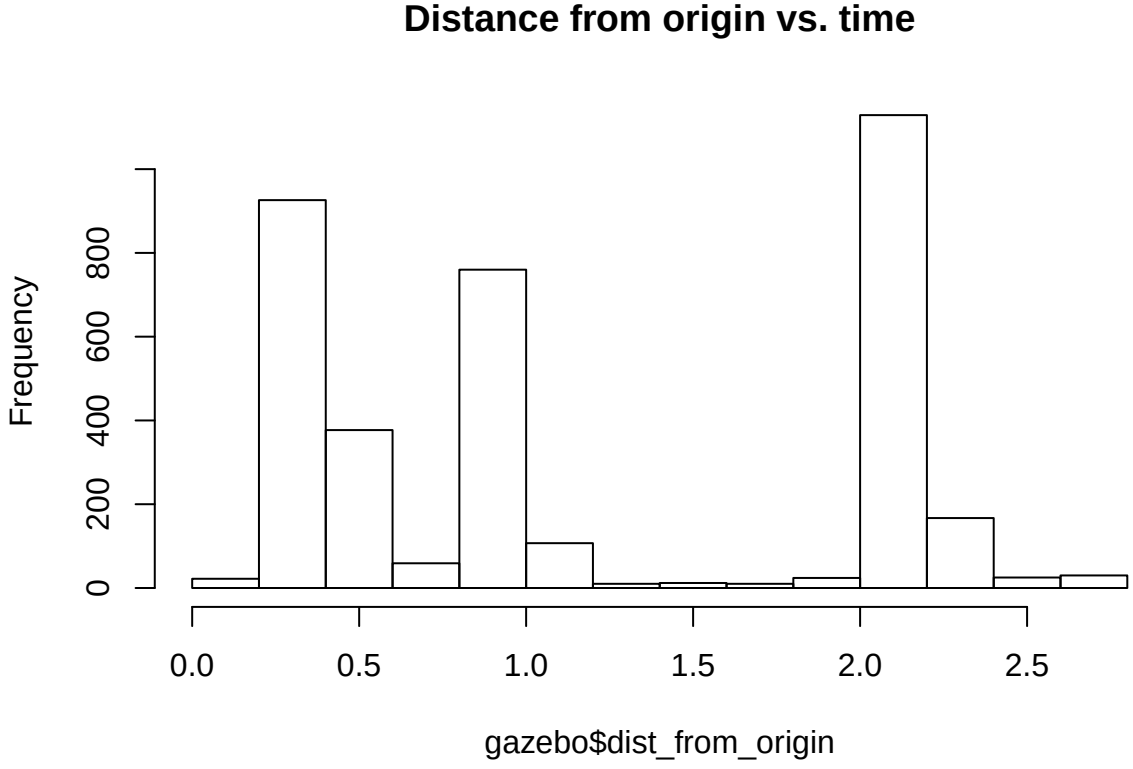
```
##      Length Class  Mode
## [1,] 1      -none- numeric
## [2,] 1      -none- numeric
```

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

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




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

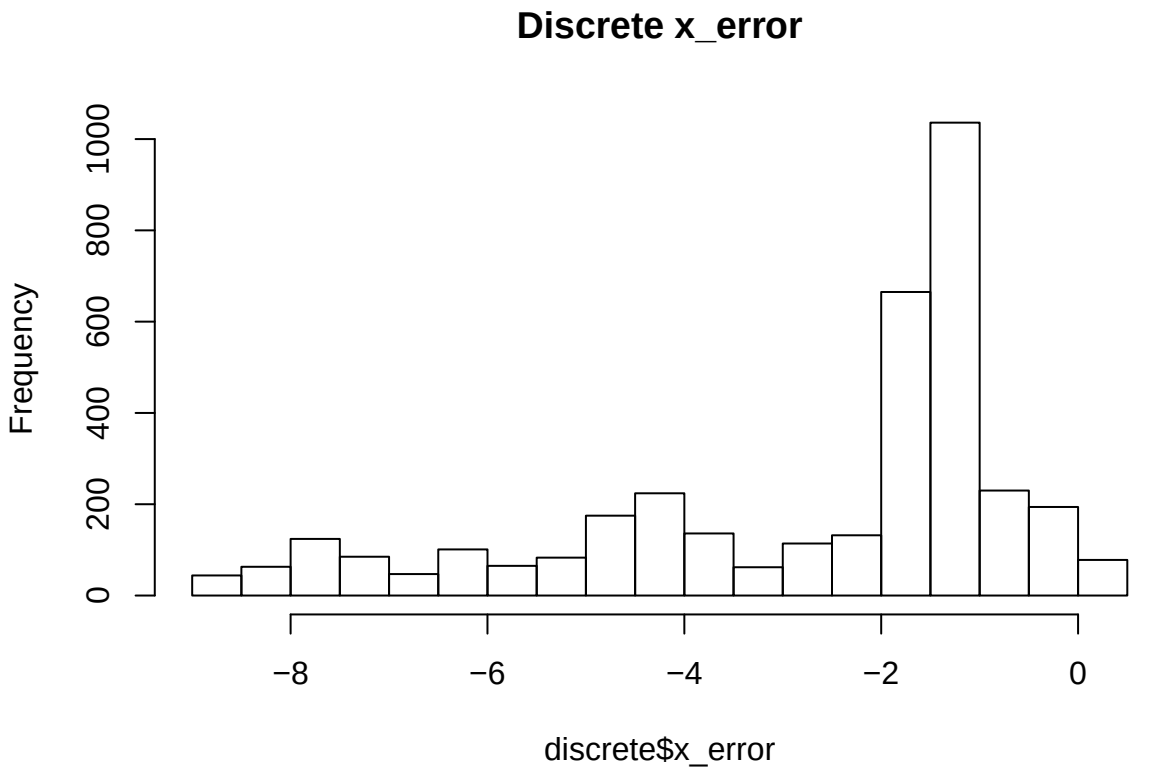


```r
hist(continuous$x_error,
     main = "Continuous x_error")
```

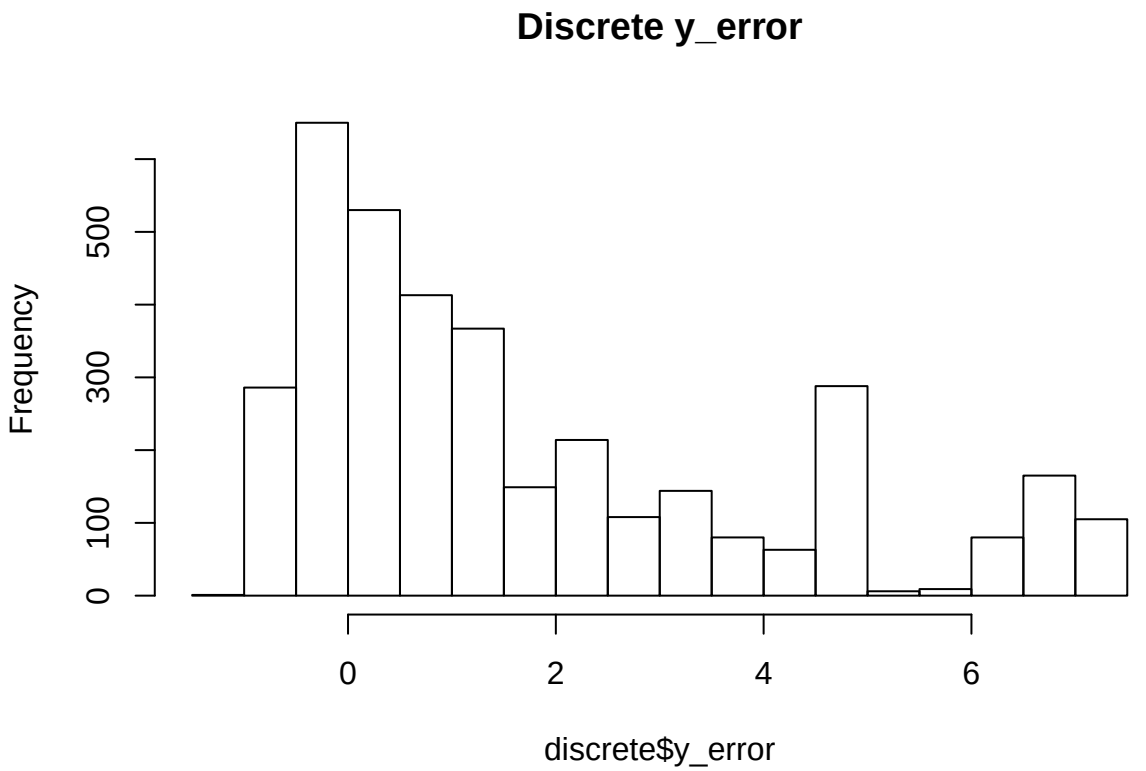

```r
hist(continuous$y_error,
      main = "Continuous y_error")
```

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

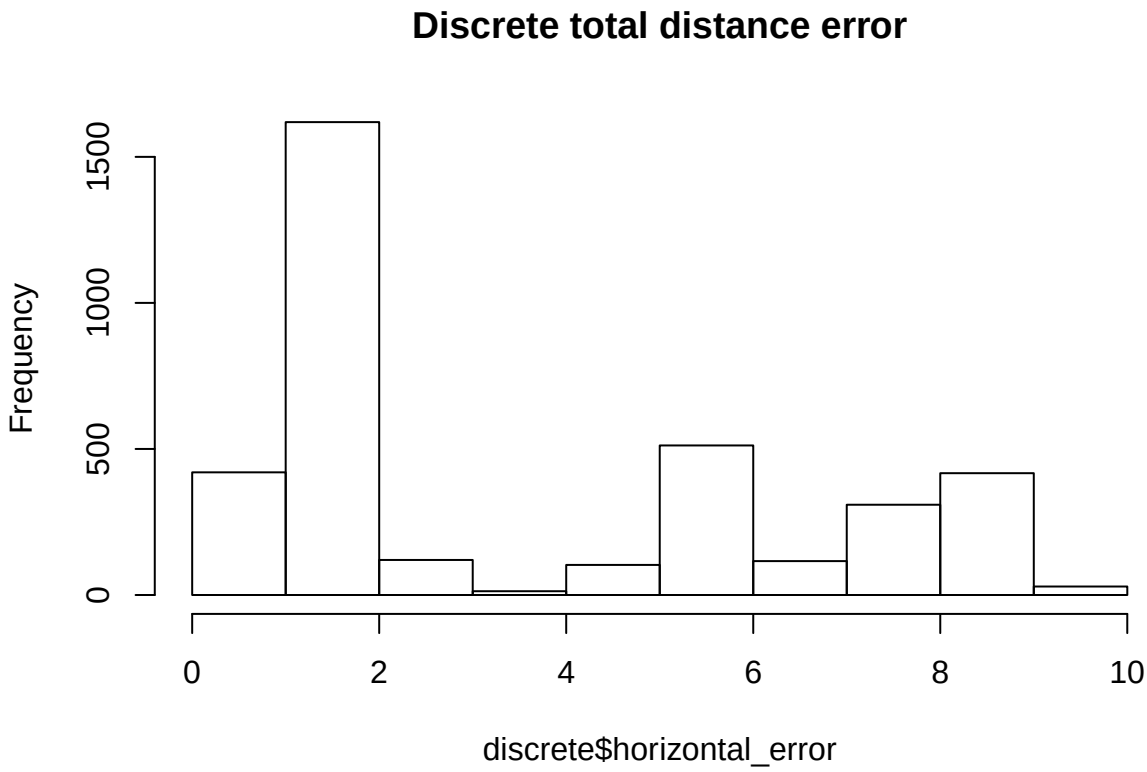

```r
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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: Mon, Aug 15, 2016 - 04:03:50 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 & 3,658 & 0.435 & 2.200 & $-$8.074 & 2.183 \\
## y\_position & 3,658 & $-$0.746 & 1.783 & $-$5.840 & 0.748 \\
## yaw & 3,658 & $-$0.161 & 1.253 & $-$3.132 & 3.111 \\
## x\_variance & 3,658 & 10.969 & 6.219 & 0.133 & 21.864 \\
## y\_variance & 3,658 & 10.969 & 6.219 & 0.133 & 21.864 \\
## yaw\_variance & 3,658 & 10.045 & 5.711 & 0.122 & 19.985 \\
## yaw\_error & 3,658 & 0.339 & 1.892 & $-$3.141 & 3.135 \\
## x\_error & 3,658 & 0.320 & 1.290 & $-$0.681 & 6.076 \\
```

```
## y\_error & 3,658 & 0.840 & 2.066 & $-$0.479 & 7.047 \\
## horizontal\_error & 3,658 & 1.332 & 2.229 & 0.00001 & 9.305 \\
## \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: Mon, Aug 15, 2016 - 04:03:50 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 & 3,658 & 3.465 & 1.928 & $-$0.000 & 8.609 \\
## y\_position & 3,658 & $-$1.678 & 2.096 & $-$7.347 & 0.980 \\
## yaw & 3,658 & $-$0.038 & 1.230 & $-$3.140 & 3.072 \\
## x\_variance & 3,658 & 0.319 & 0.600 & 0.0002 & 3.691 \\
## y\_variance & 3,658 & 0.319 & 0.600 & 0.0002 & 3.691 \\
## yaw\_variance & 3,658 & 10.050 & 5.712 & 0.123 & 19.983 \\
## x\_error & 3,658 & $-$2.710 & 2.270 & $-$8.751 & 0.200 \\
## y\_error & 3,658 & 1.773 & 2.289 & $-$1.030 & 7.305 \\
## horizontal\_error & 3,658 & 3.573 & 2.848 & 0.00001 & 9.131 \\
## yaw\_error & 3,658 & 0.332 & 1.906 & $-$3.131 & 3.139 \\
## \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)
}
```