one_mobile_no_gps Experiment Report

Matthew Swartwout

August 15, 2016

This is a summary of the data from the one_mobile_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.
## -87.58000 -62.74000 -34.02000 -37.45000  -4.84600   0.03437
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -105.600  -64.900  -17.840  -34.810   -2.915    0.000
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -3.1370 -1.4250  0.1371  0.0973  1.6490  3.1410
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
##   0.00001   5.65600  38.42000  51.71000  90.27000 137.20000
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -88.38000 -63.17000 -34.06000 -37.62000  -4.59200   0.02959
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -105.100  -64.640  -17.910  -34.690   -2.826    0.000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -3.14000 -1.42400  0.13920  0.09454  1.64700  3.13900
```

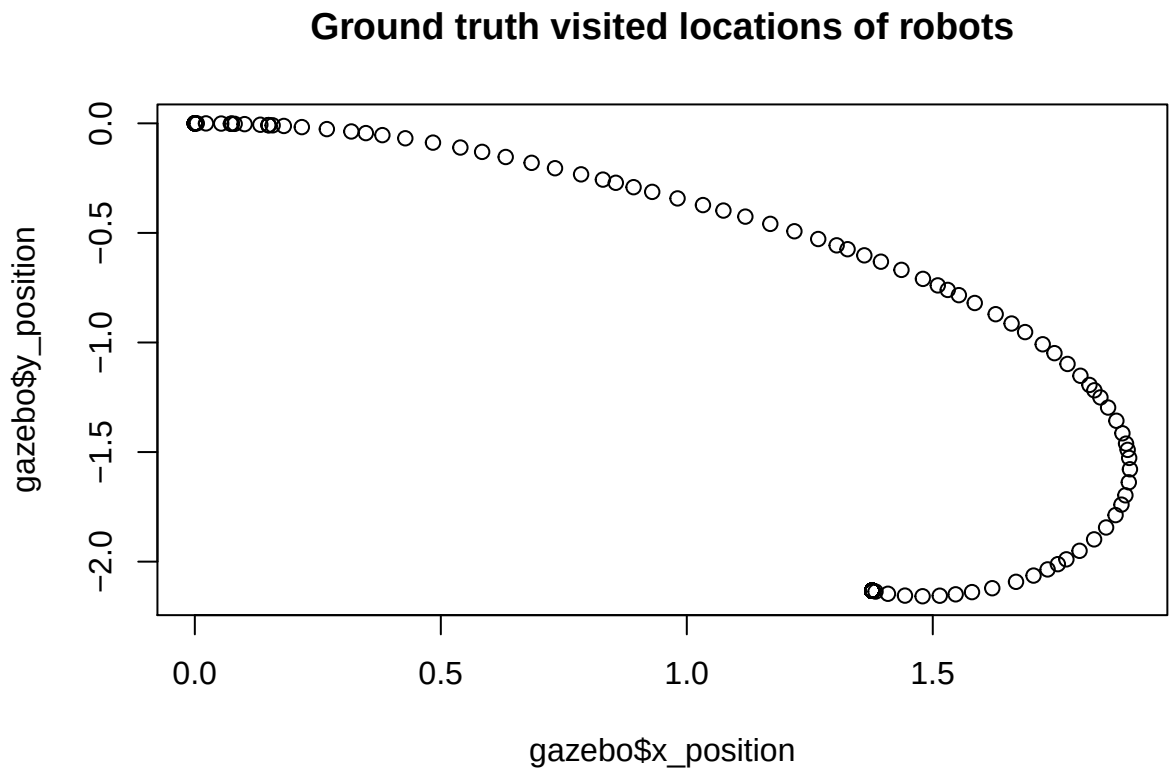
```
summary(discrete$horizontal_error)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
##   0.00001   5.39200  38.48000  51.73000  90.38000 137.30000
```

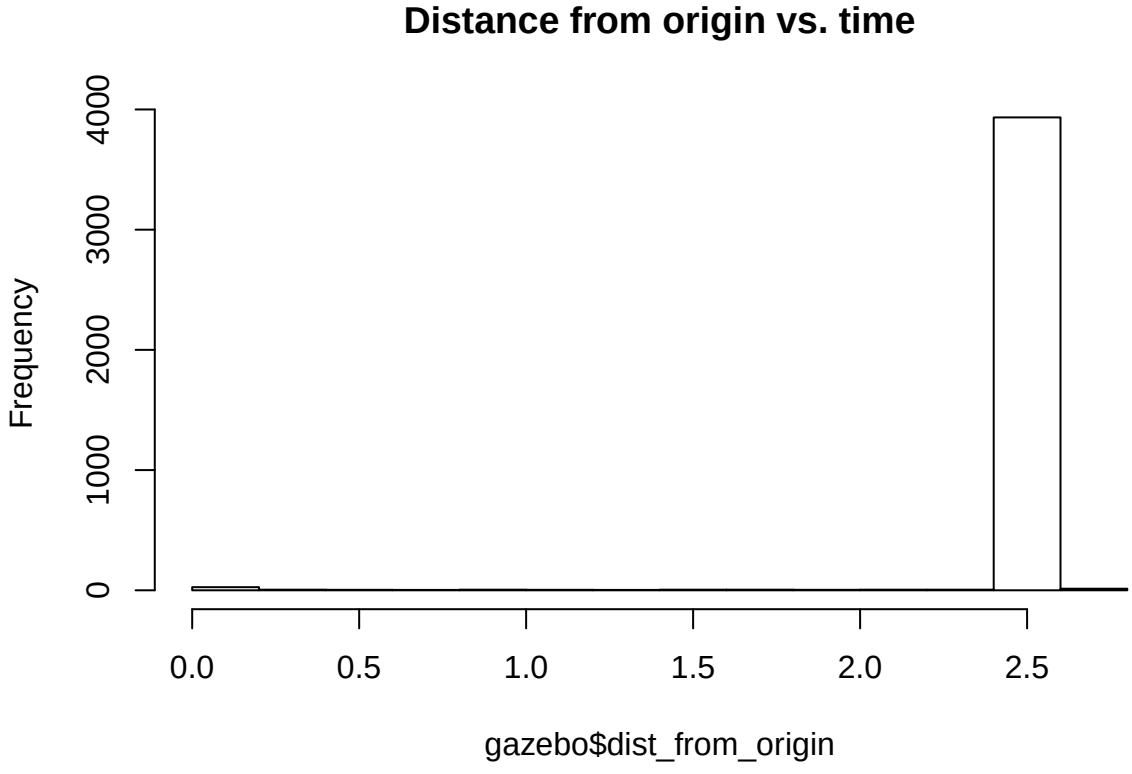
```
if (params$robot >= 2) {
    summary(external_data_averages)
}
```

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

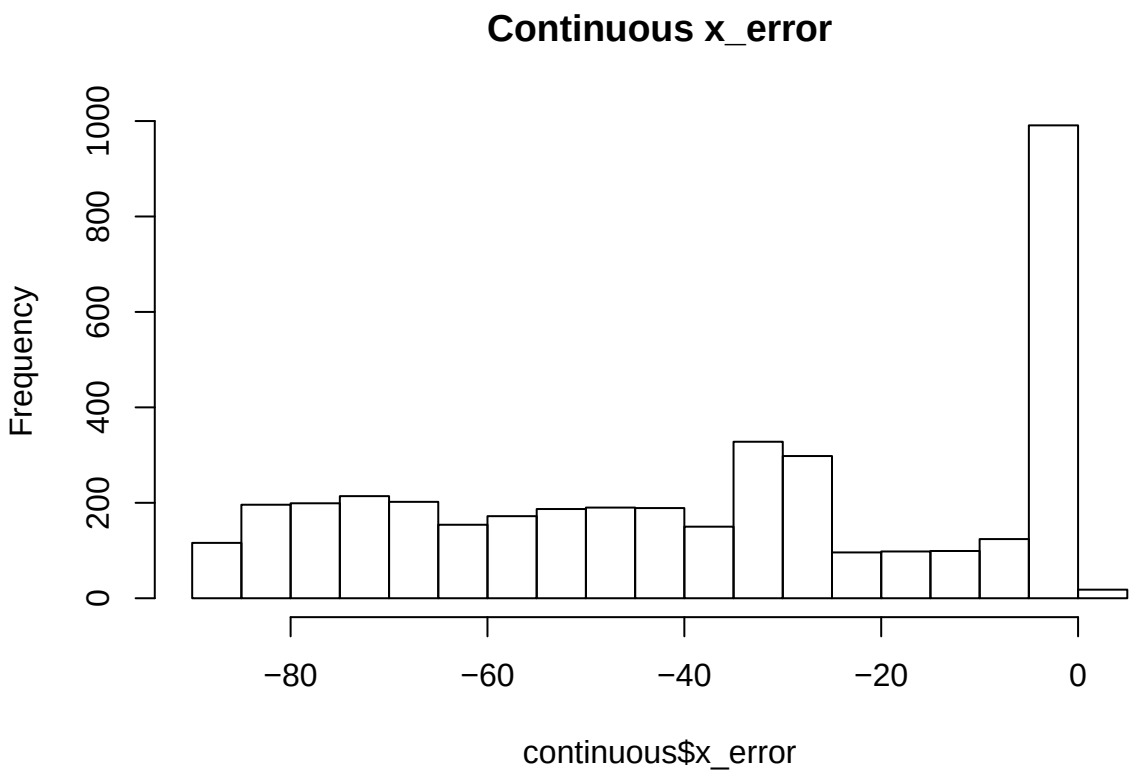
```
plot(gazebo$x_position, gazebo$y_position,
     main = "Ground truth visited locations of robots")
```



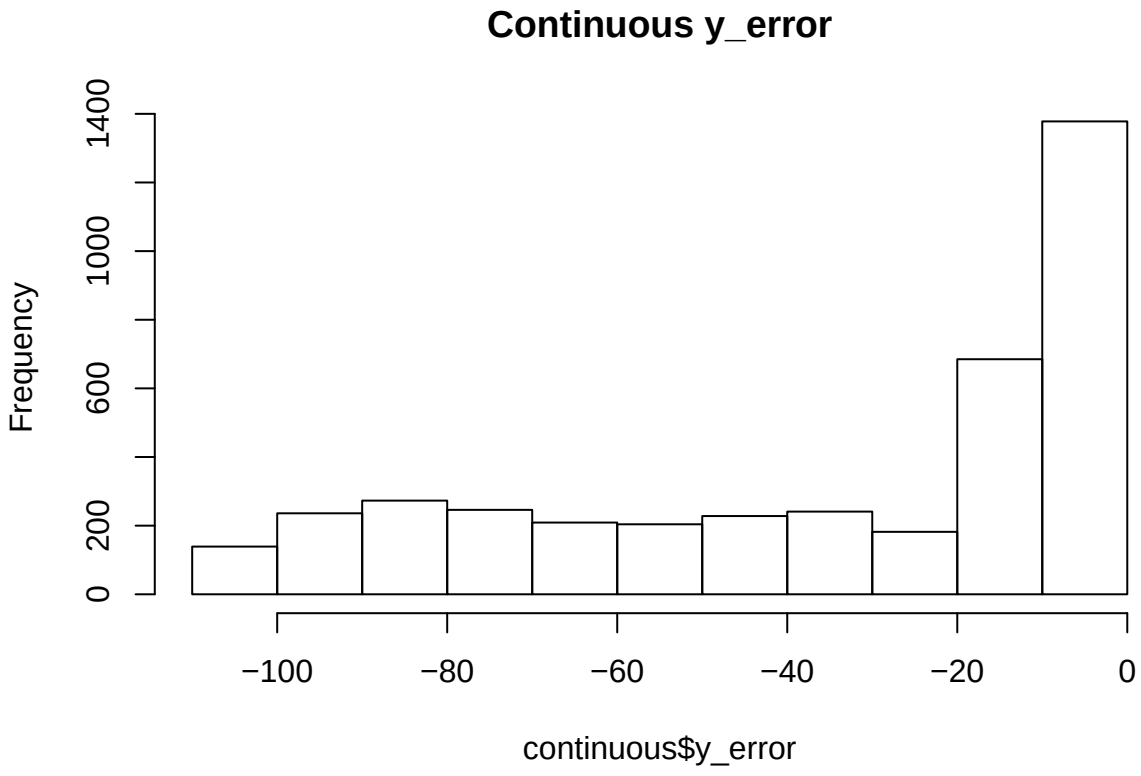

```
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```



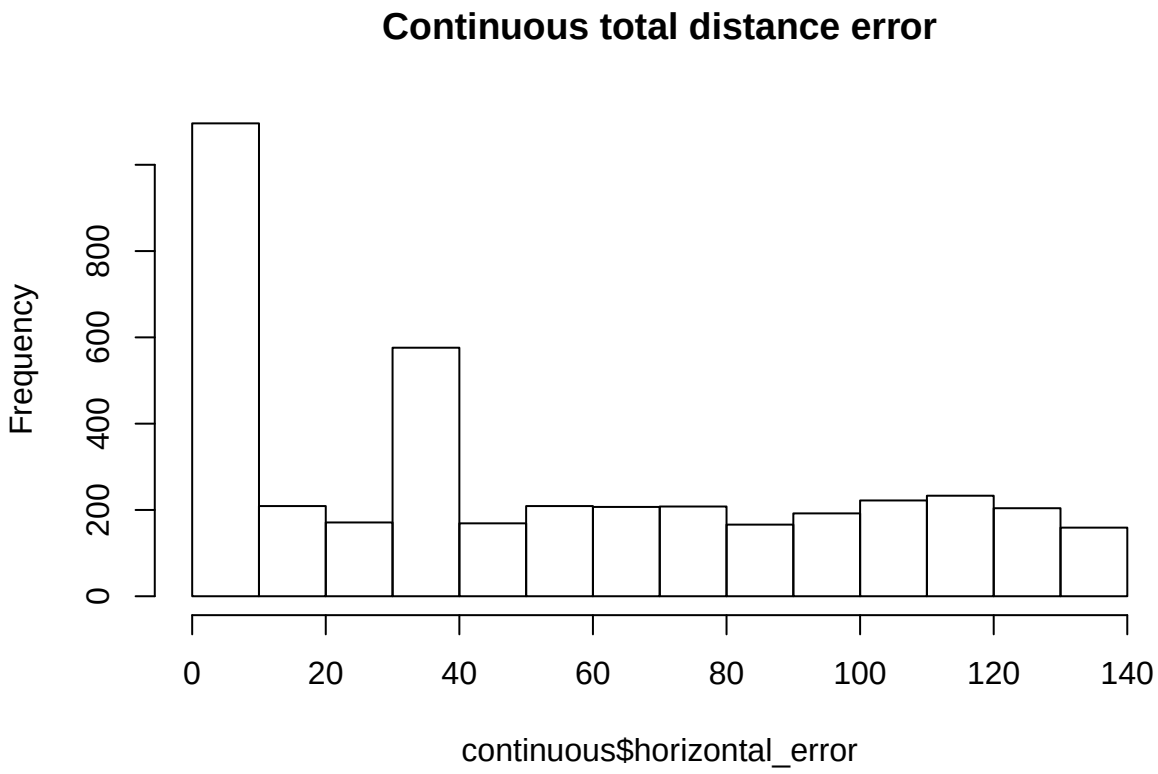

```
hist(continuous$x_error,
     main = "Continuous x_error")
```



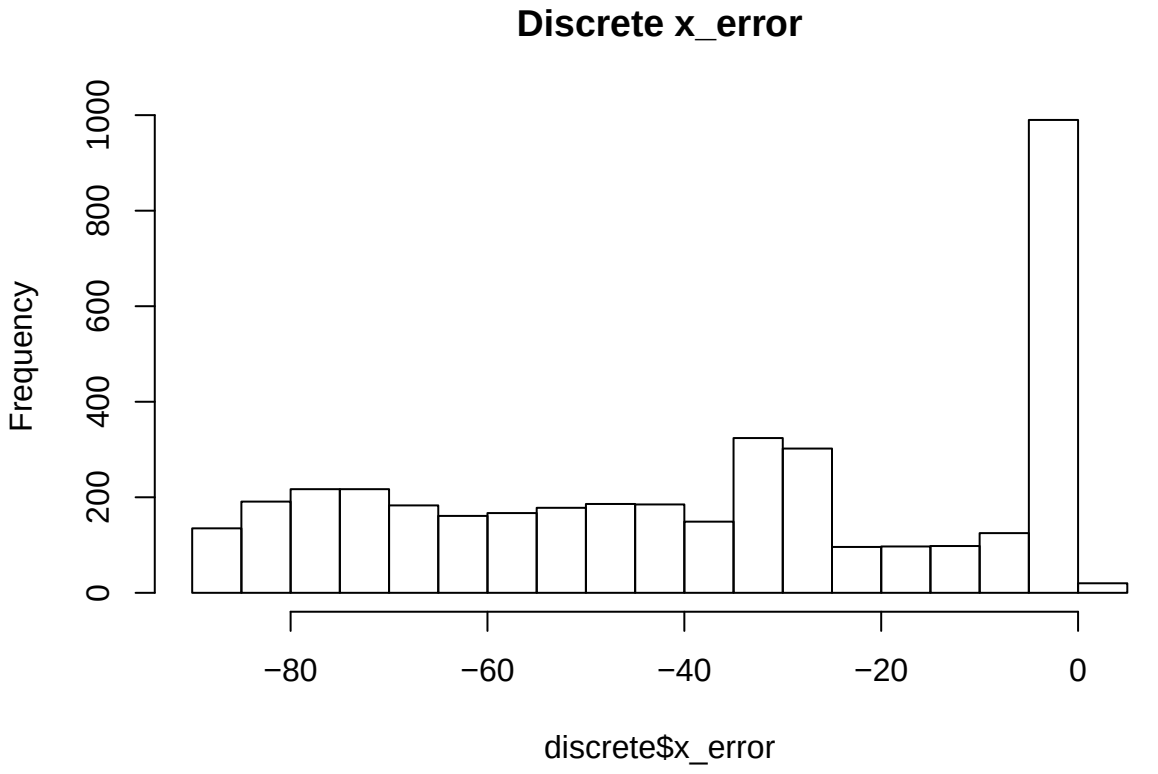

```
hist(continuous$y_error,
      main = "Continuous y_error")
```



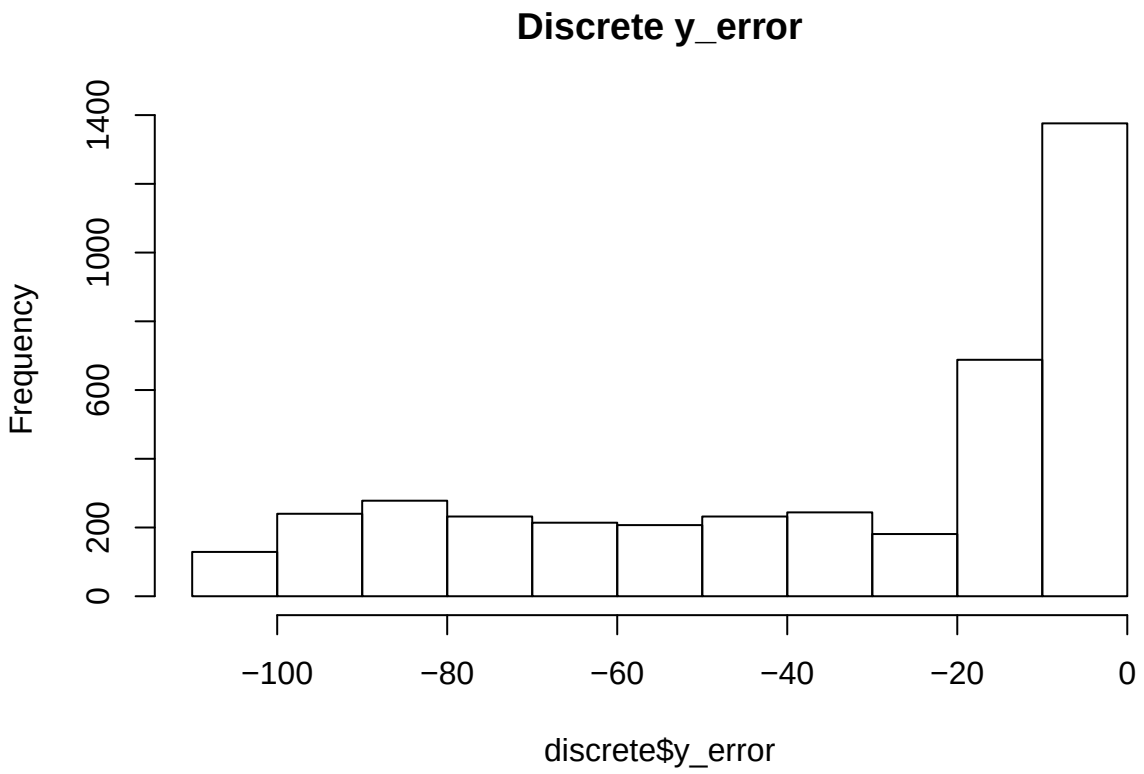

```
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



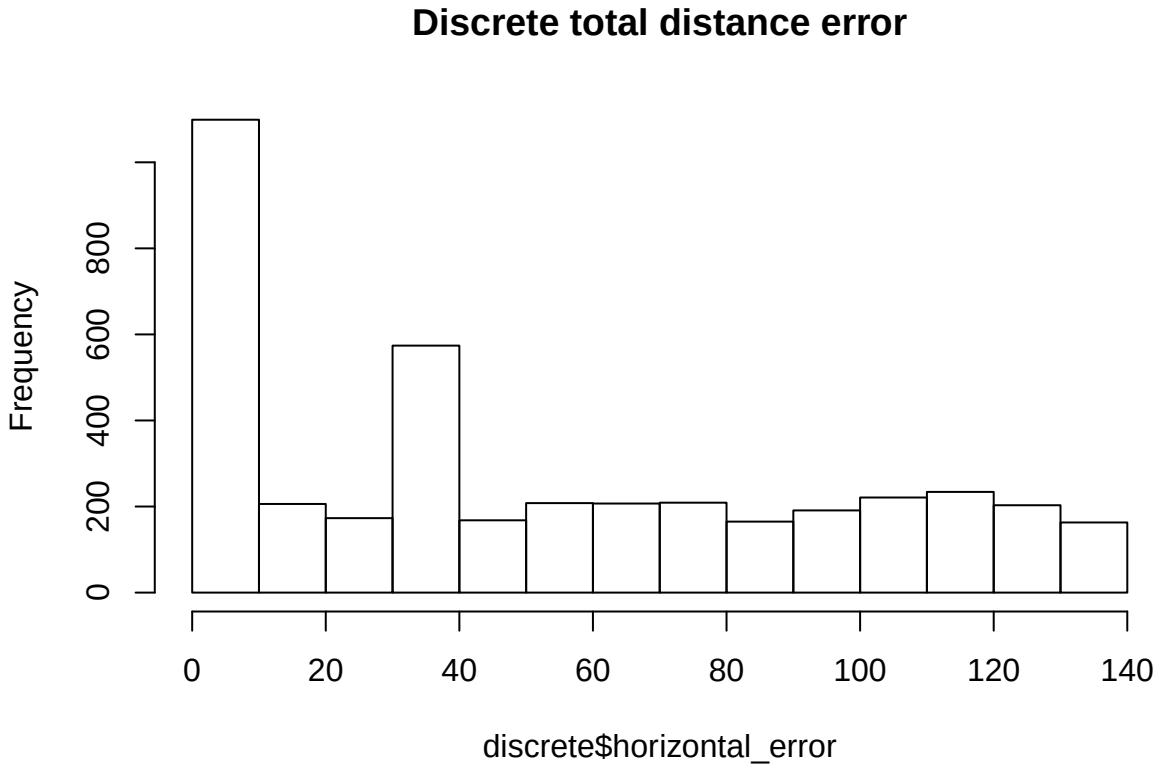

```
hist(discrete$x_error,
     main = "Discrete x_error")
```




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




```
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 - 04:01:34 PM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for one-mobile-no-gps Experiment}
##   \label{tab:one_mobile_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 & 4,021 & 38.821 & 28.117 & $-$0.000 & 88.952 \\
## y\_position & 4,021 & 32.715 & 33.934 & $-$0.000 & 103.454 \\
## yaw & 4,021 & 0.615 & 0.466 & $-$1.144 & 1.049 \\
## x\_variance & 4,021 & 50.063 & 34.388 & 0.071 & 106.207 \\
## y\_variance & 4,021 & 46.239 & 45.619 & 0.071 & 145.610 \\
## yaw\_variance & 4,021 & 65.588 & 54.795 & 0.085 & 175.733 \\
## yaw\_error & 4,021 & 0.097 & 1.828 & $-$3.137 & 3.141 \\
## x\_error & 4,021 & $-$37.453 & 28.105 & $-$87.575 & 0.034 \\
## y\_error & 4,021 & $-$34.814 & 33.967 & $-$105.587 & 0.000 \\
## horizontal\_error & 4,021 & 51.712 & 43.407 & 0.00001 & 137.179 \\
```

```
## \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 - 04:01:35 PM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for one-mobile-no-gps Experiment}
##   \label{tab:one_mobile_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 & 4,021 & 38.989 & 28.396 & $-$0.000 & 89.752 \\
## y\_position & 4,021 & 32.594 & 33.776 & $-$0.000 & 102.968 \\
## yaw & 4,021 & 0.609 & 0.461 & $-$1.144 & 1.039 \\
## x\_variance & 4,021 & 50.406 & 34.762 & 0.071 & 107.515 \\
## y\_variance & 4,021 & 45.898 & 45.190 & 0.071 & 144.294 \\
## yaw\_variance & 4,021 & 65.609 & 54.808 & 0.085 & 175.766 \\
## x\_error & 4,021 & $-$37.621 & 28.384 & $-$88.375 & 0.030 \\
## y\_error & 4,021 & $-$34.693 & 33.809 & $-$105.101 & 0.000 \\
## horizontal\_error & 4,021 & 51.732 & 43.491 & 0.00001 & 137.319 \\
## yaw\_error & 4,021 & 0.095 & 1.829 & $-$3.140 & 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)
}
```