one_stationary Experiment Report

Matthew Swartwout

August 09, 2016

This is a summary of the data from the one_stationary 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.
## -2.435e-05 -2.453e-06  9.956e-06  6.500e-06  1.751e-05  2.653e-05
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -1.389e-08  3.917e-07  9.480e-07  8.416e-07  1.106e-06  1.878e-06
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 4.595e-06 4.320e-05 5.157e-05 5.111e-05 5.705e-05 1.037e-04
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 9.155e-07 7.692e-06 1.356e-05 1.299e-05 1.851e-05 2.656e-05
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -5.219000 -0.606700 -0.004763 -0.049990  0.564000  5.427000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -4.15200 -0.59980 -0.01710 -0.02167  0.52490  3.54400
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -5.166e-05  7.761e-06  2.539e-05  3.648e-05  4.768e-05  4.618e-03
```

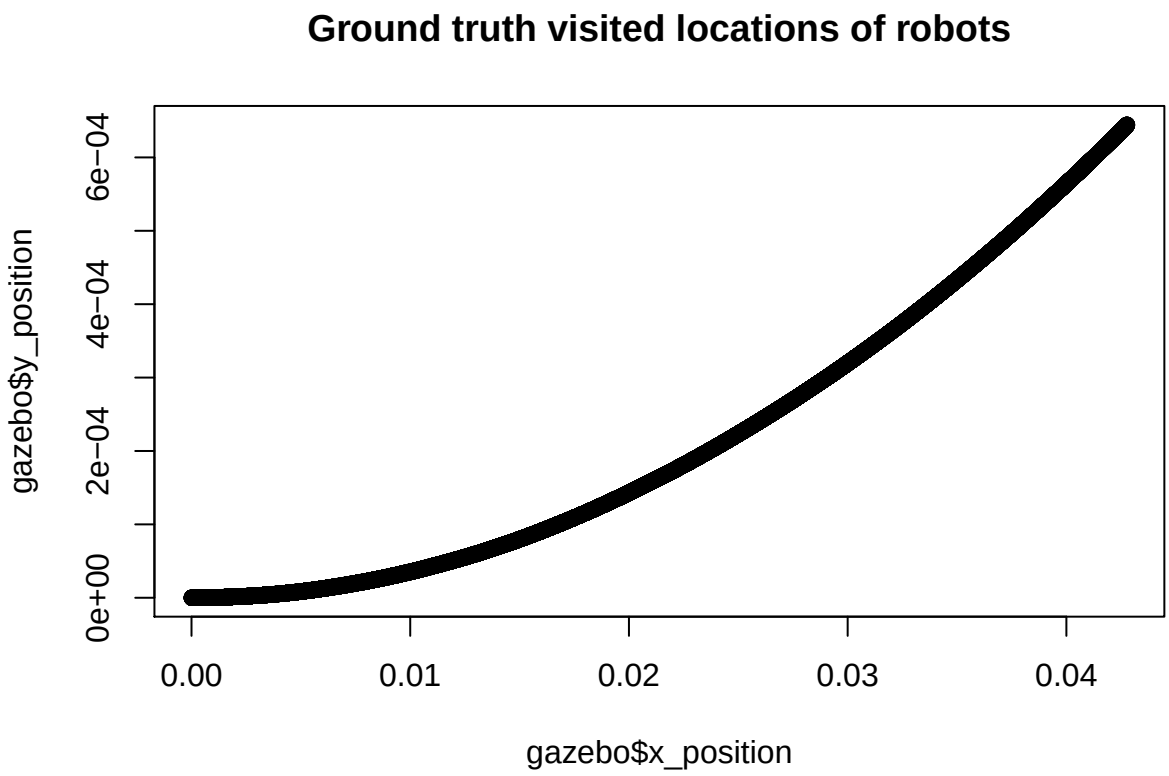
```r
summary(discrete$horizontal_error)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.001537 0.541100 1.095000 1.335000 1.979000 5.529000
```

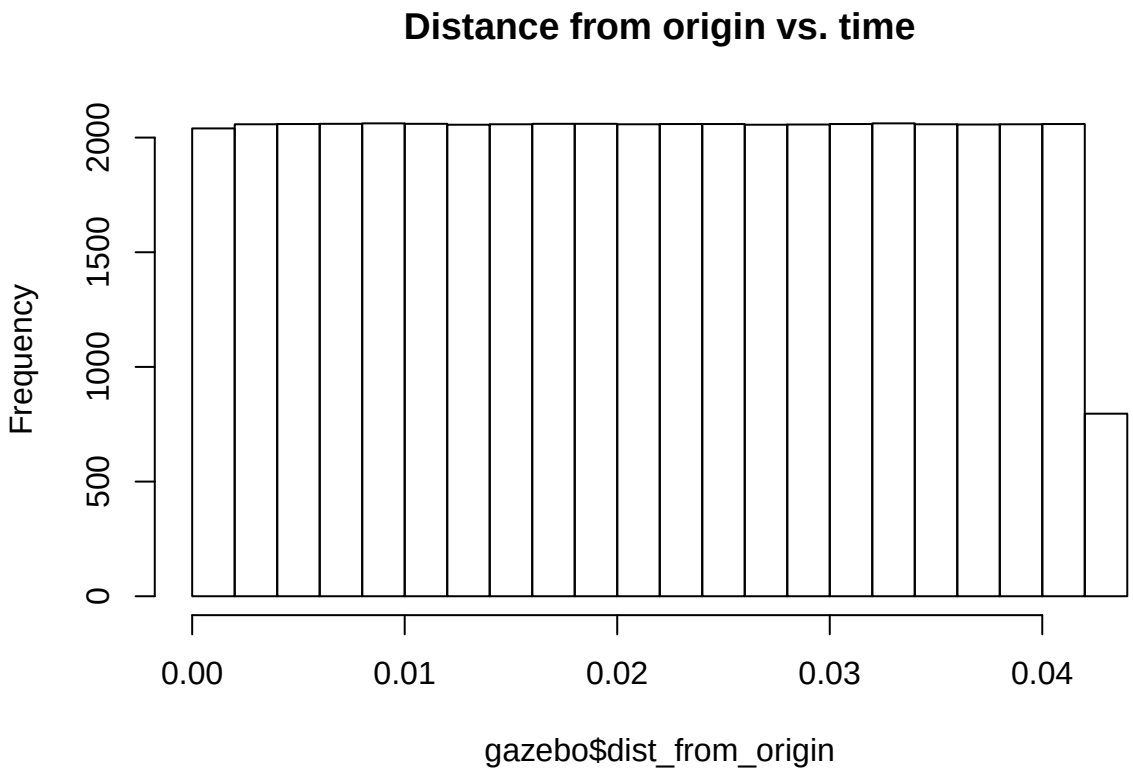
```r
if (params$robot >= 2) {
    summary(external_data_averages)
}
```

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

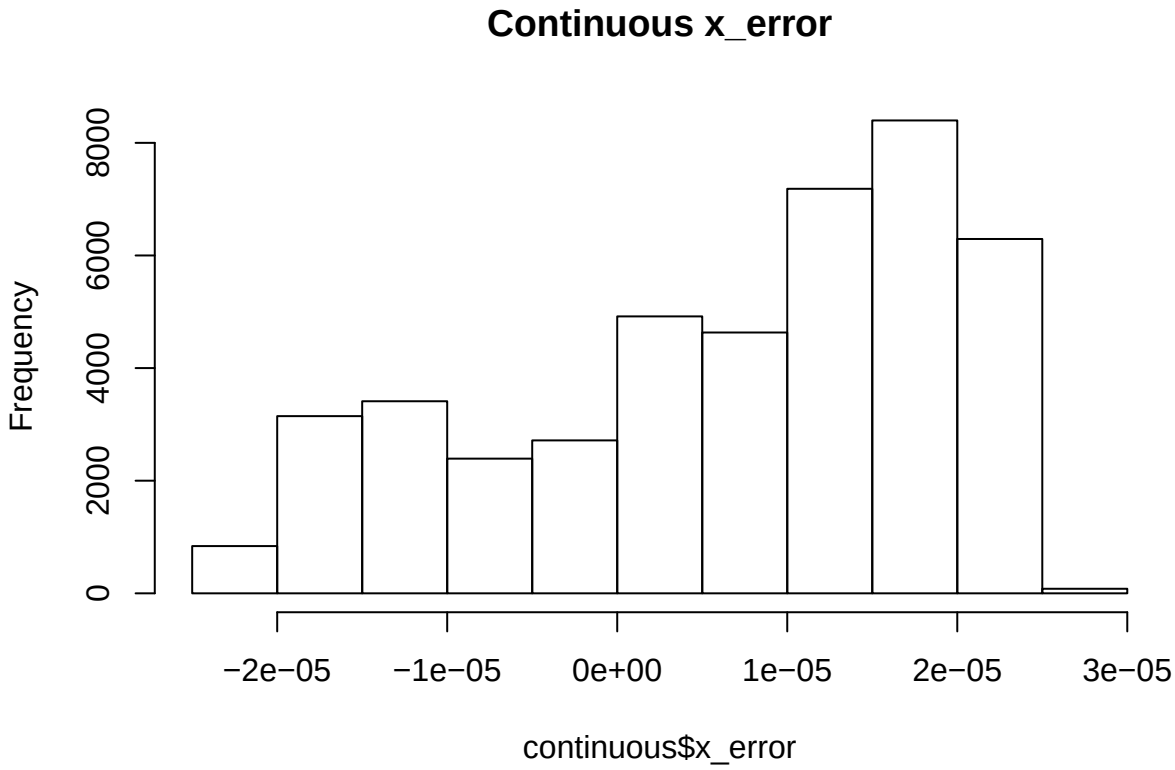
```r
plot(gazebo$x_position, gazebo$y_position,
     main = "Ground truth visited locations of robots")
```



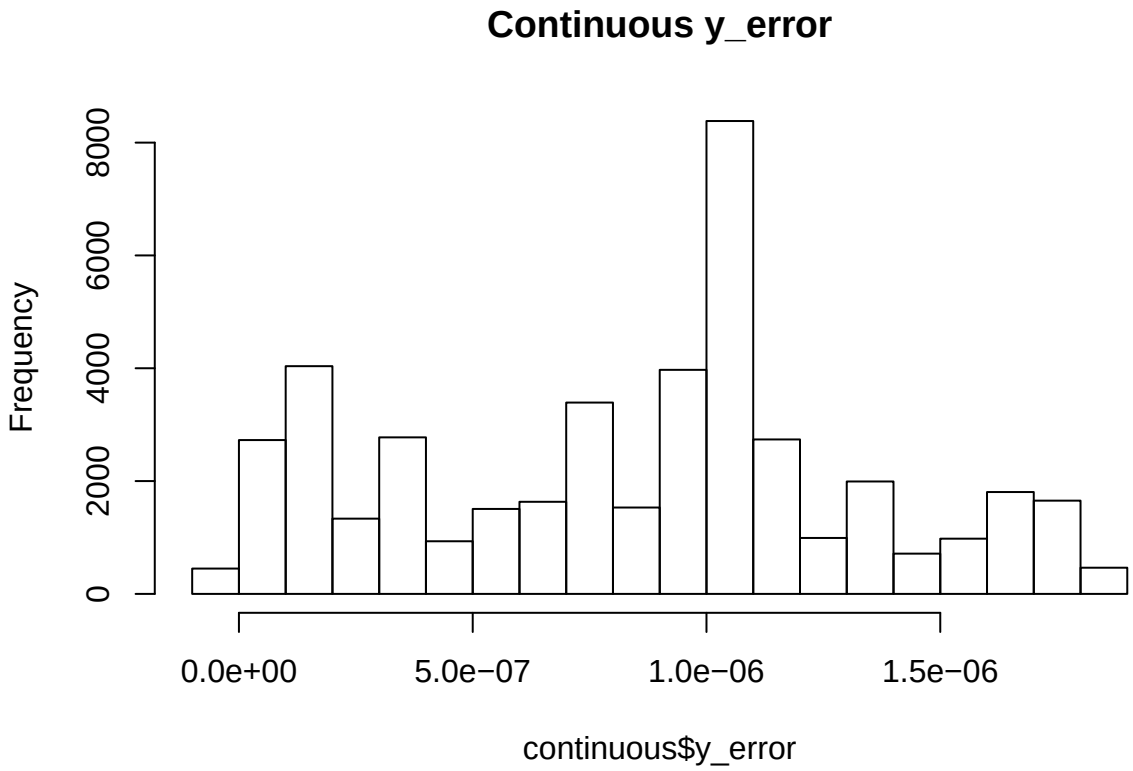

```r
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```



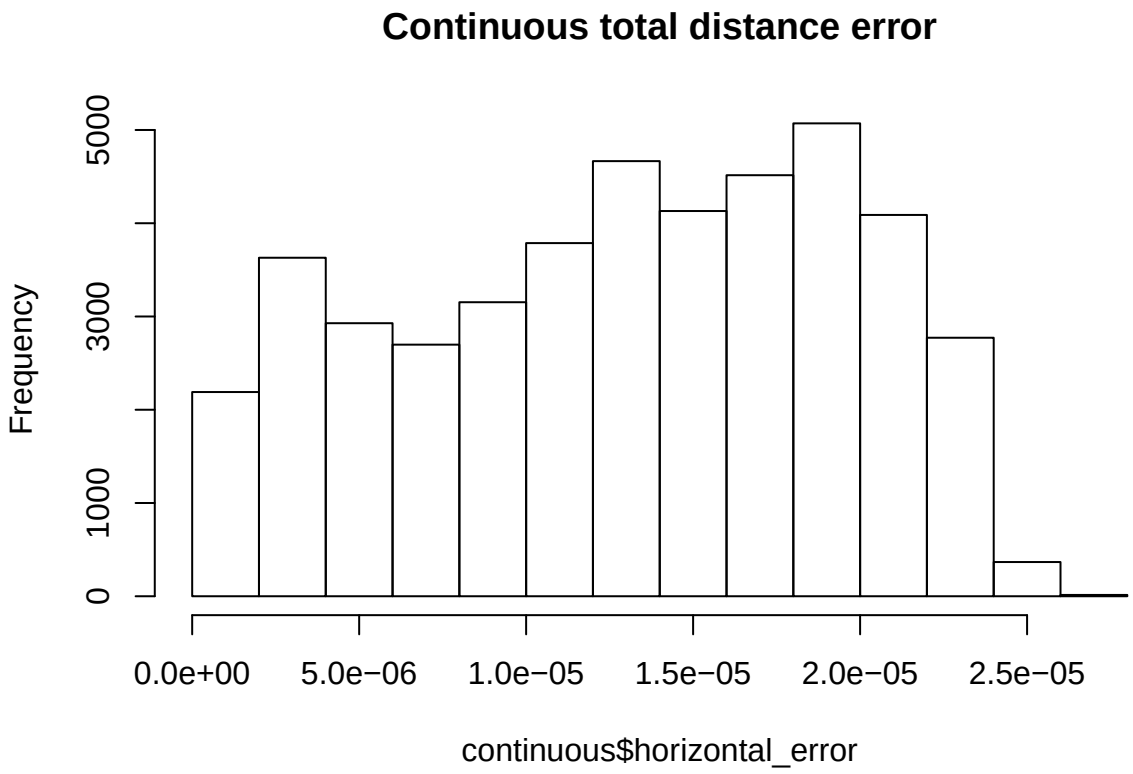

```
hist(continuous$x_error,
     main = "Continuous x_error")
```



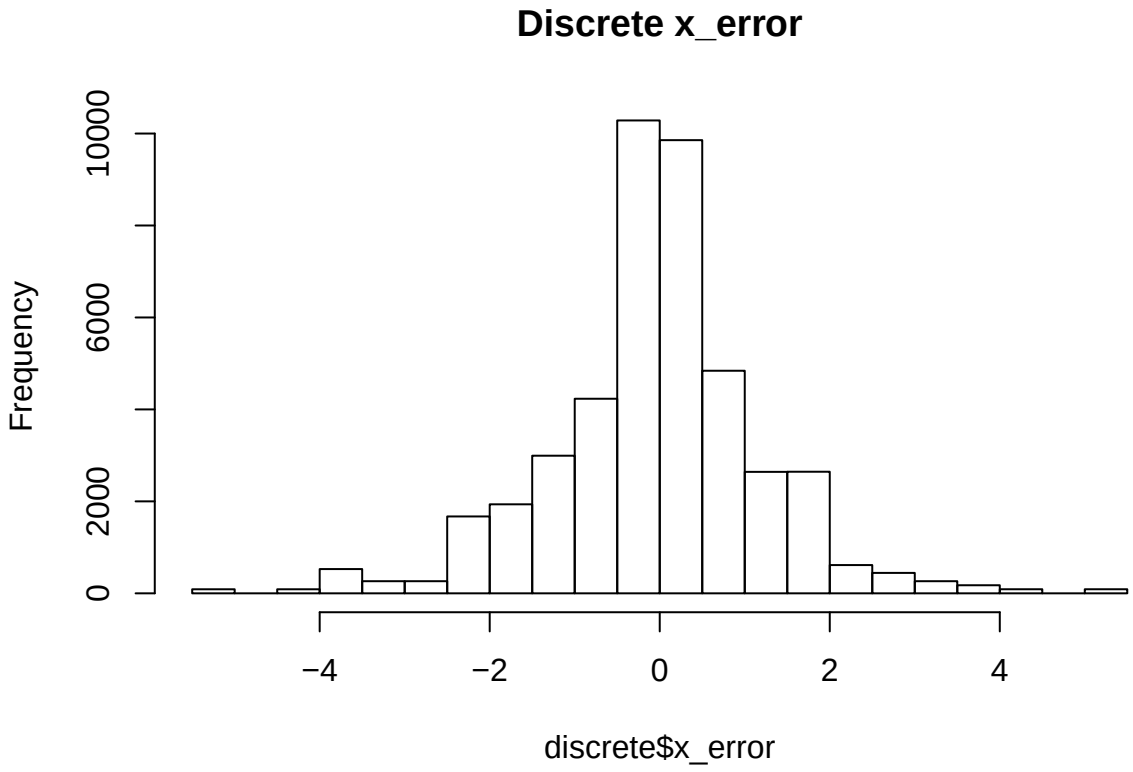
```r
hist(continuous$y_error,
     main = "Continuous y_error")
```



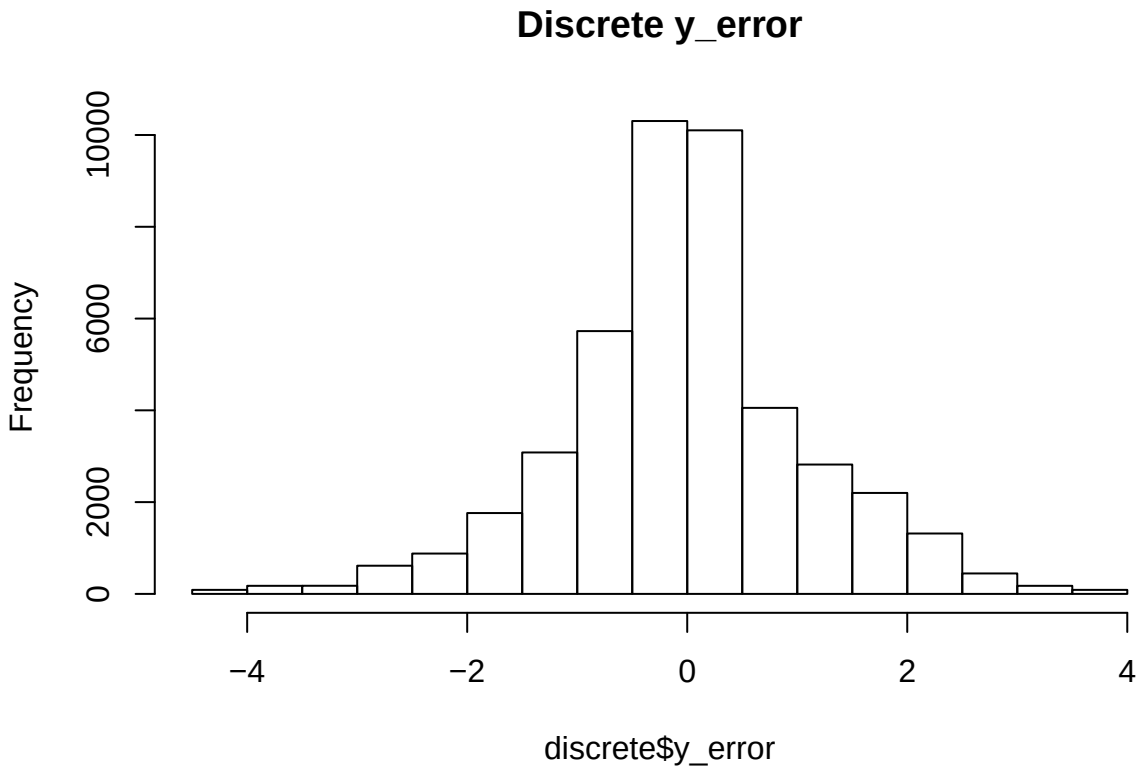

```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



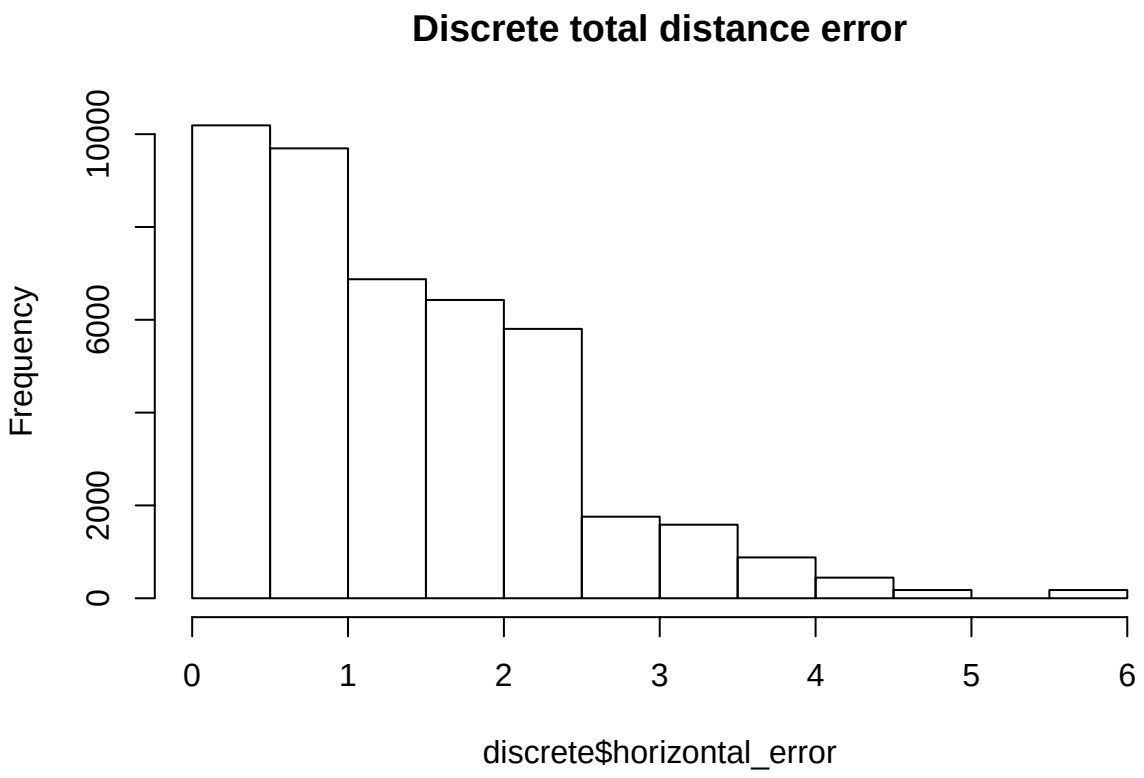

```
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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: Tue, Aug 09, 2016 - 09:46:28 AM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for one-stationary Experiment}
##   \label{tab:one_stationary_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 & 44,011 & 0.021 & 0.012 & $-$0.000002 & 0.043 \\
## y\_position & 44,011 & 0.0002 & 0.0002 & 0.000 & 0.001 \\
## yaw & 44,011 & 0.015 & 0.009 & 0.00002 & 0.030 \\
## yaw\_error & 44,011 & 0.0001 & 0.00001 & 0.000005 & 0.0001 \\
## x\_error & 44,011 & 0.00001 & 0.00001 & $-$0.00002 & 0.00003 \\
## y\_error & 44,011 & 0.000001 & 0.0000005 & $-$0.000 & 0.000002 \\
## horizontal\_error & 44,011 & 0.00001 & 0.00001 & 0.000001 & 0.00003 \\
## \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: Tue, Aug 09, 2016 - 09:46:28 AM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for one-stationary Experiment}
##   \label{tab:one_stationary_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 & 44,011 & 0.071 & 1.247 & $-$5.421 & 5.237 \\
## y\_position & 44,011 & 0.022 & 1.112 & $-$3.544 & 4.152 \\
## yaw & 44,011 & 0.015 & 0.009 & $-$0.005 & 0.030 \\
## x\_error & 44,011 & $-$0.050 & 1.247 & $-$5.219 & 5.427 \\
## y\_error & 44,011 & $-$0.022 & 1.112 & $-$4.152 & 3.544 \\
## horizontal\_error & 44,011 & 1.335 & 1.007 & 0.002 & 5.529 \\
## yaw\_error & 44,011 & 0.00004 & 0.0002 & $-$0.0001 & 0.005 \\
## \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)
}
```