one_mobile Experiment Report

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This is a summary of the data from the one_mobile 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.
## -22.6000  -6.3690  -0.7929  -2.7570   1.7330   6.8390
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  -9.166   1.445   5.675   6.219   9.915  20.620
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -3.14200 -1.13800  0.05122 -0.01191  1.00000  3.14100
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##  0.02789  4.86000  8.90200  9.71800 15.24000 22.65000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -6.41700 -0.67390  0.00810 -0.01191  0.69280  5.25700
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -7.96400 -0.64060  0.04064  0.09845  0.77630  7.32200
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.1410000 -1.4190000  0.0001334  0.0200500  1.5000000  3.1420000
```

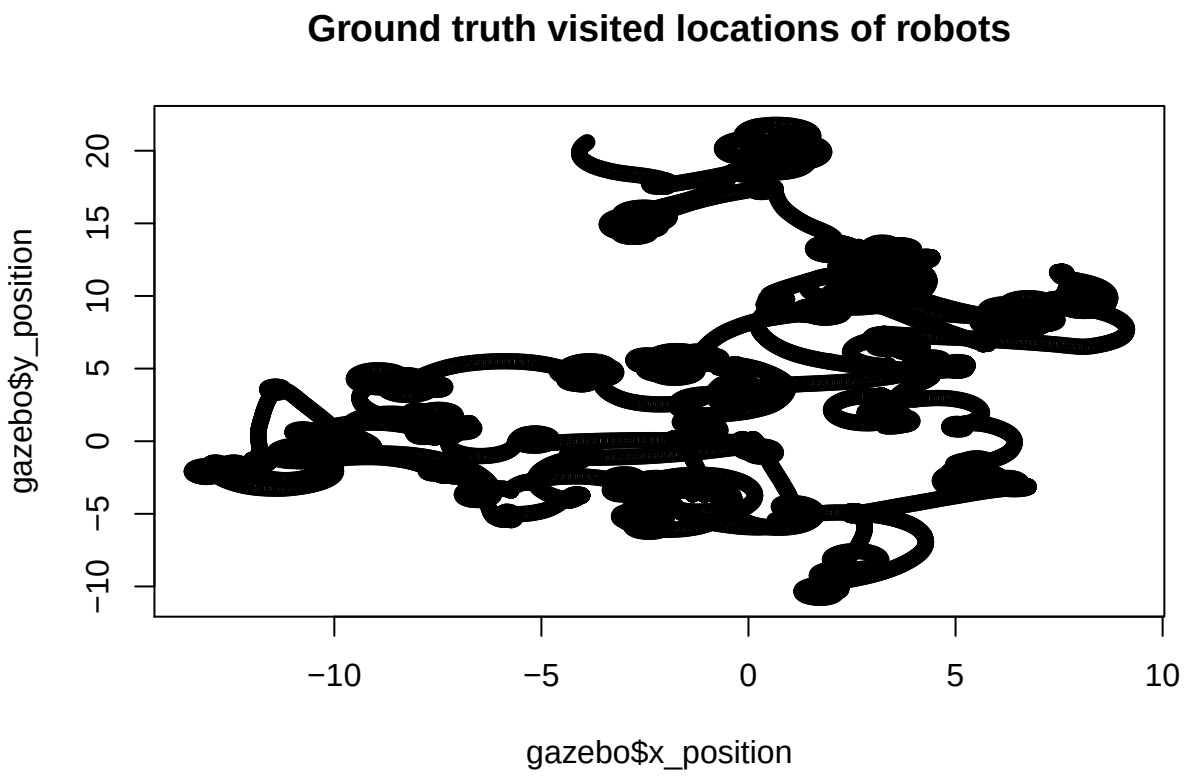
```
summary(discrete$horizontal_error)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.000012 0.672100 1.315000 1.568000 2.203000 8.840000
```

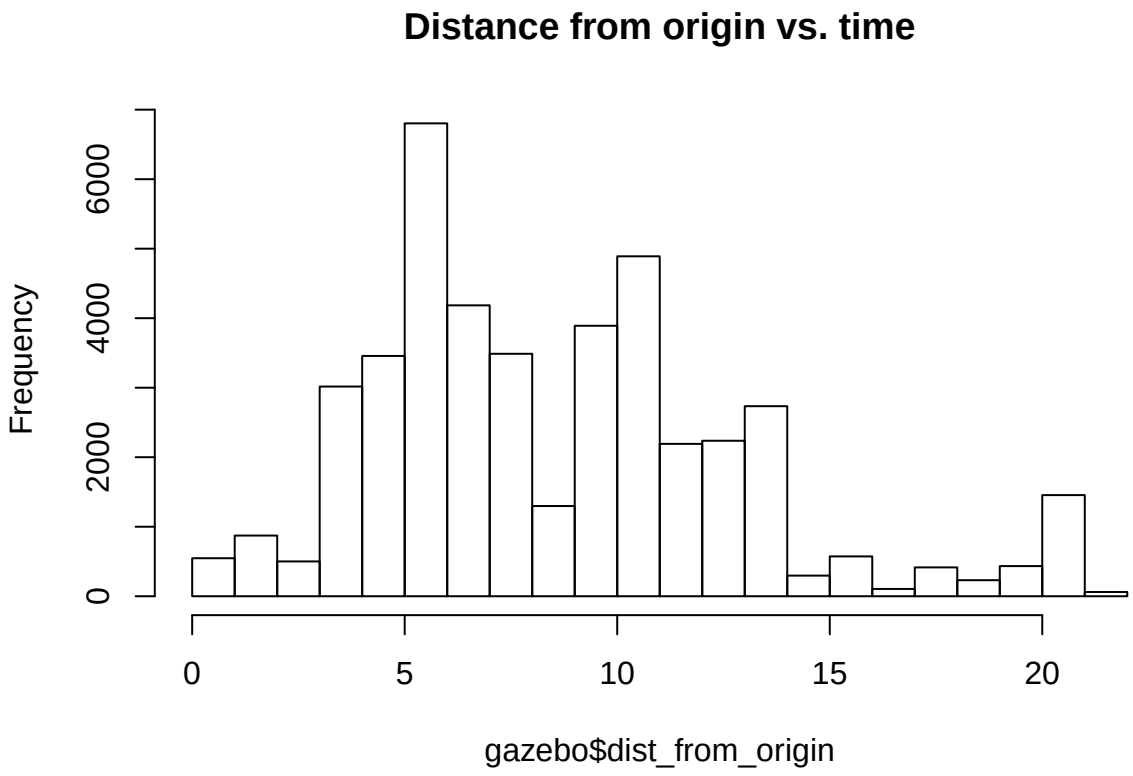
```
if (params$robot >= 2) {
    summary(external_data_averages)
}
```

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

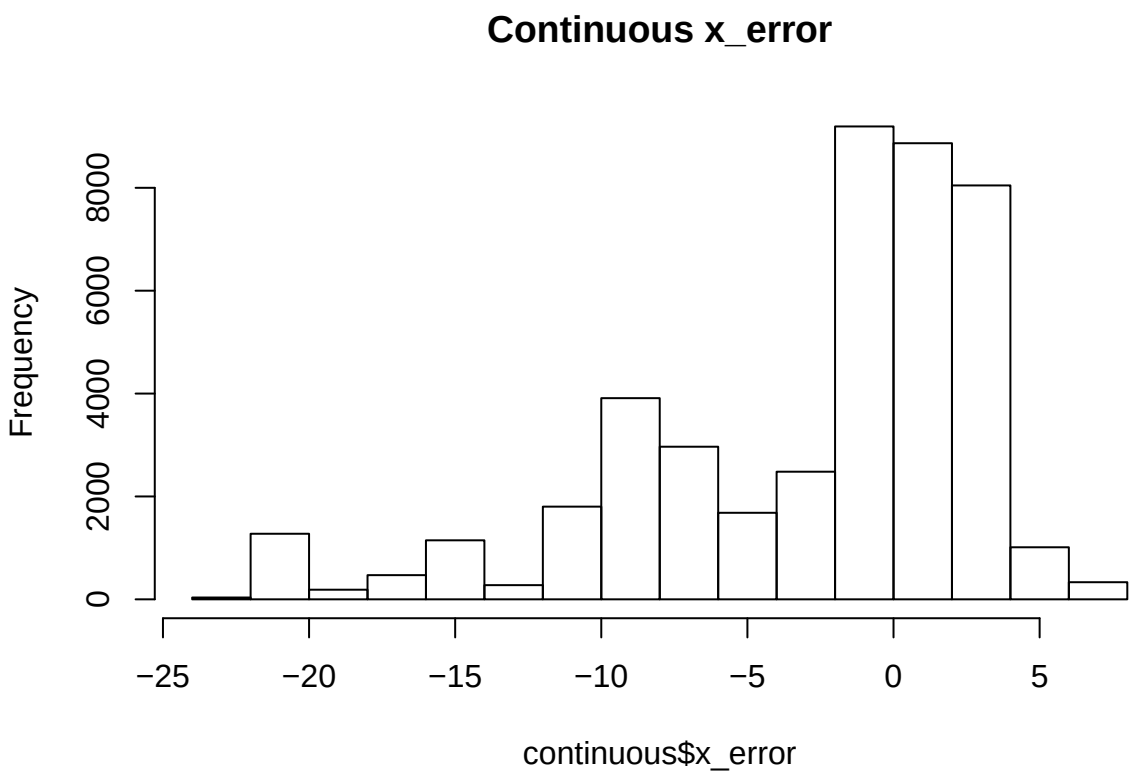
```
plot(gazebo$x_position, gazebo$y_position,
     main = "Ground truth visited locations of robots")
```



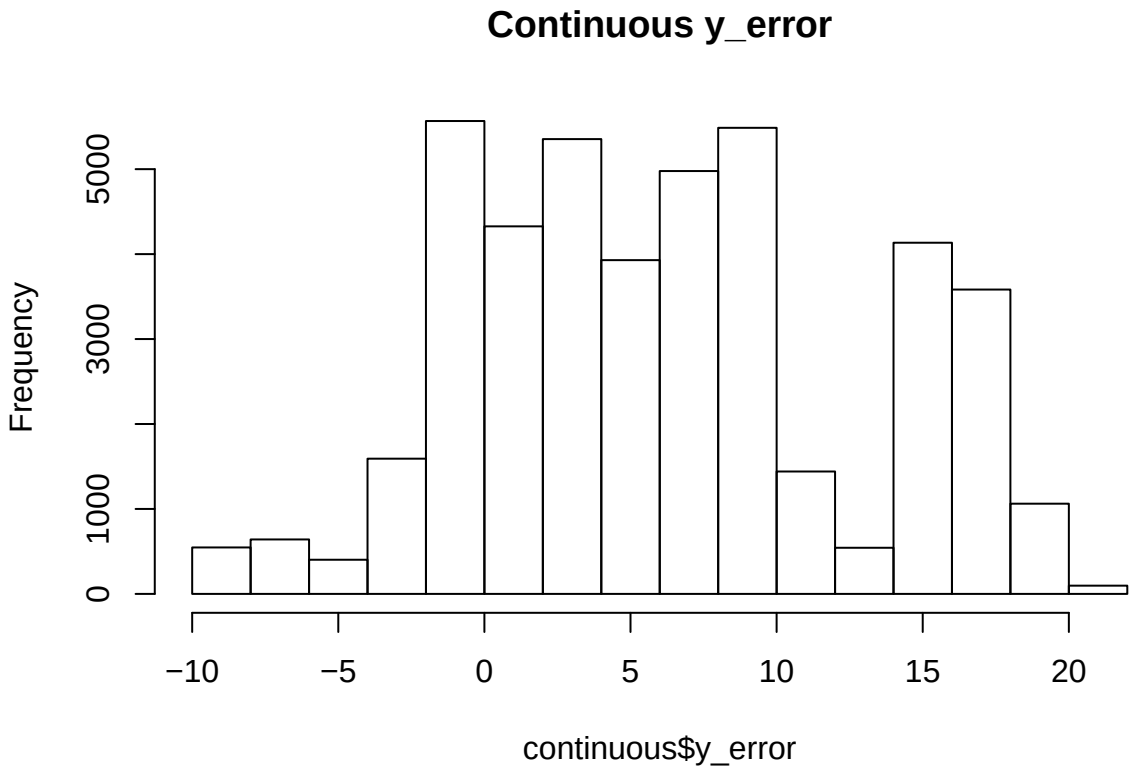

```
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```



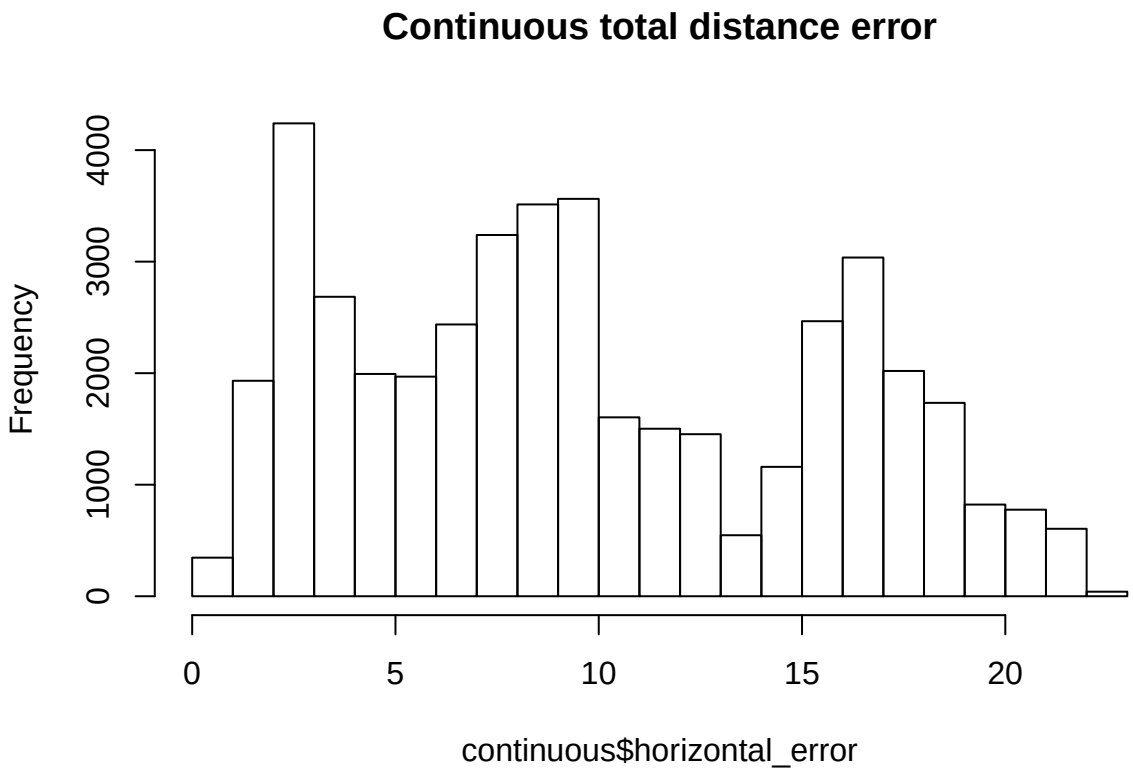

```
hist(continuous$x_error,
     main = "Continuous x_error")
```



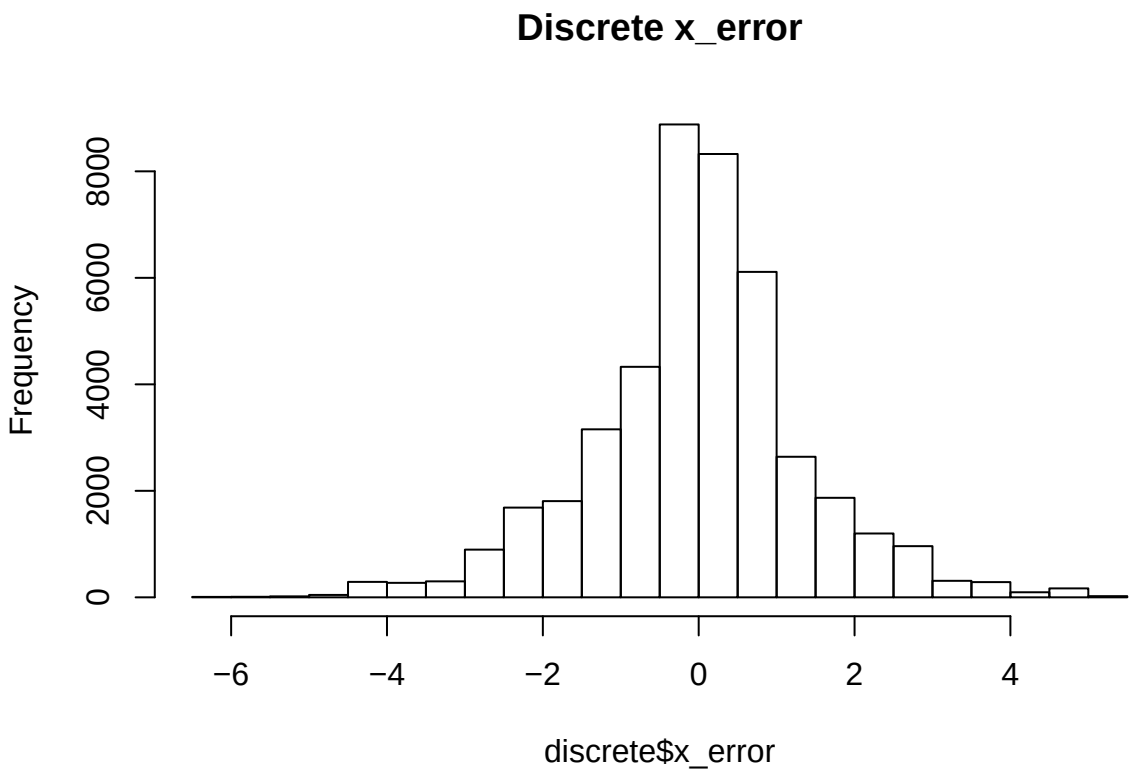
```r
hist(continuous$y_error,
     main = "Continuous y_error")
```



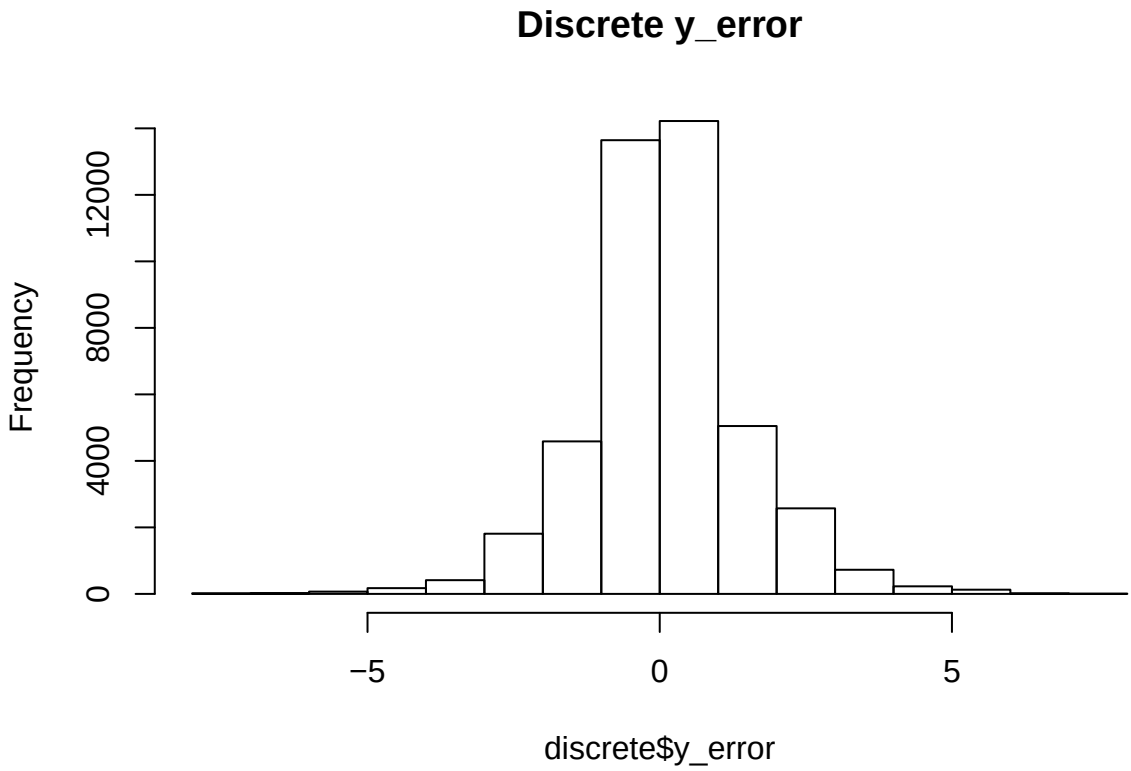

```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



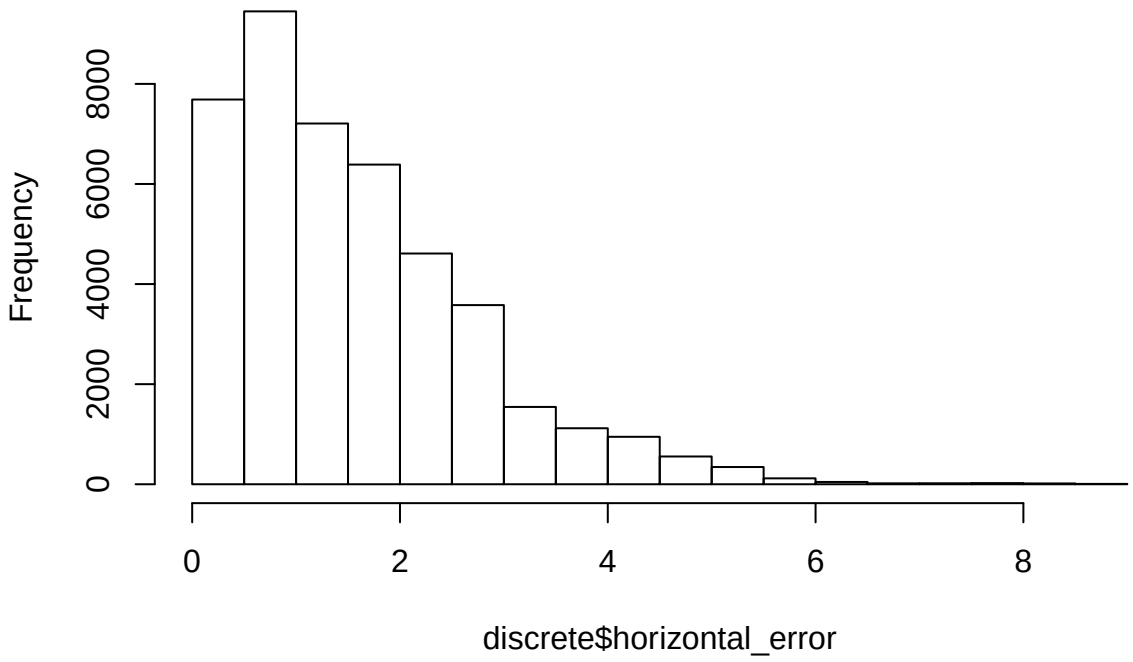

```
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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 - 09:46:14 AM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for one-mobile Experiment}
##   \label{tab:one_mobile_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 & 43,684 & 2.536 & 3.005 & $-$3.761 & 10.251 \\
## y\_position & 43,684 & $-$2.040 & 5.072 & $-$15.305 & 10.223 \\
## yaw & 43,684 & $-$0.011 & 1.809 & $-$3.142 & 3.142 \\
## yaw\_error & 43,684 & $-$0.012 & 1.583 & $-$3.142 & 3.141 \\
## x\_error & 43,684 & $-$2.757 & 6.071 & $-$22.602 & 6.839 \\
## y\_error & 43,684 & 6.219 & 6.599 & $-$9.166 & 20.619 \\
## horizontal\_error & 43,684 & 9.718 & 5.677 & 0.028 & 22.651 \\
## \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 - 09:46:15 AM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for one-mobile Experiment}
##   \label{tab:one_mobile_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 & 43,684 & $-$0.209 & 5.254 & $-$14.451 & 10.598 \\
## y\_position & 43,684 & 4.080 & 7.106 & $-$11.732 & 22.518 \\
## yaw & 43,684 & $-$0.075 & 1.818 & $-$3.141 & 3.141 \\
## x\_error & 43,684 & $-$0.012 & 1.378 & $-$6.417 & 5.257 \\
## y\_error & 43,684 & 0.098 & 1.380 & $-$7.964 & 7.322 \\
## horizontal\_error & 43,684 & 1.568 & 1.164 & 0.00001 & 8.840 \\
## yaw\_error & 43,684 & 0.020 & 1.758 & $-$3.141 & 3.142 \\
## \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)
}
```