two_mobile Experiment Report

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This is a summary of the data from the two_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.
## -8.82500 -3.53600 -0.05972  5.98300  6.03500 53.66000
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -43.550  -5.874   1.320   1.044  11.720  30.940
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -3.14100 -1.43400  0.13970  0.07326  1.67000  3.14100
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##  0.00001  5.06400  8.38800 14.89000 16.31000 61.94000
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -103.7000  -42.0700   -4.6910  -20.7800    0.2405   16.2200
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -117.0000  -16.8800   -9.1550  -12.3500    0.3598   27.3500
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -3.1400 -1.2910 -0.2595 -0.1320  1.1040  3.1410
```

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

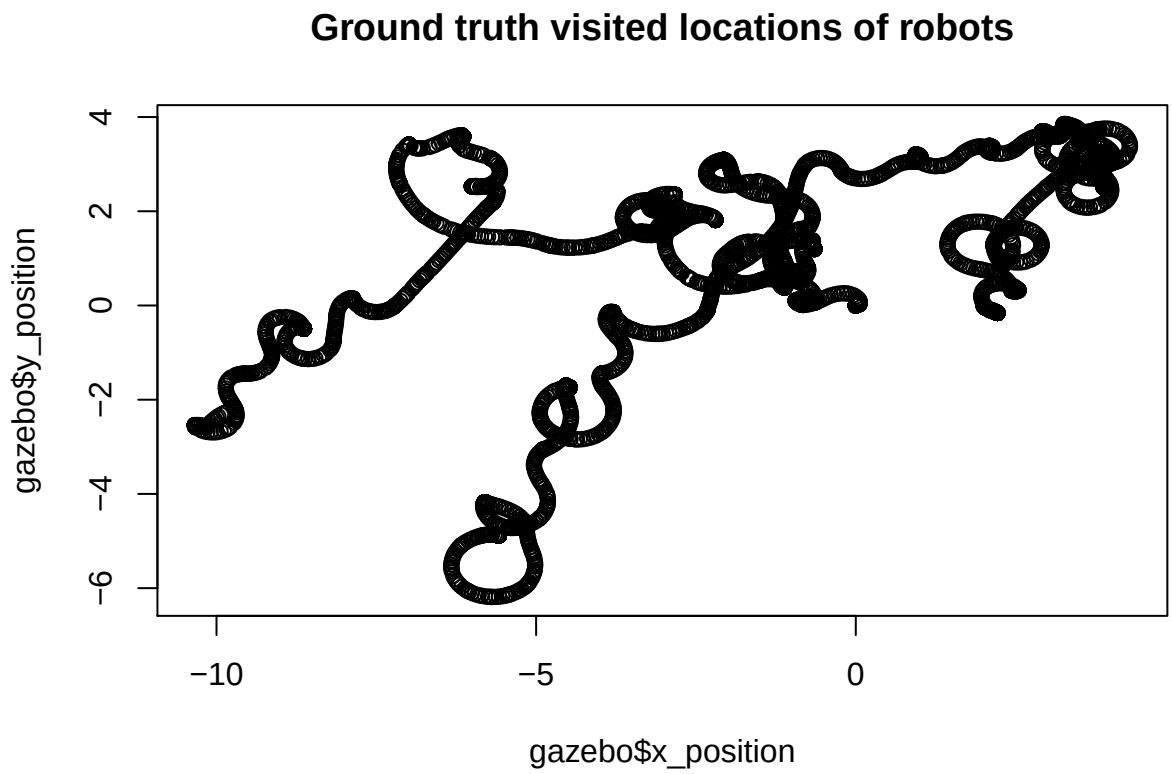
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
##   0.00002   5.60400  13.71000  29.22000  47.12000 156.40000
```

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

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

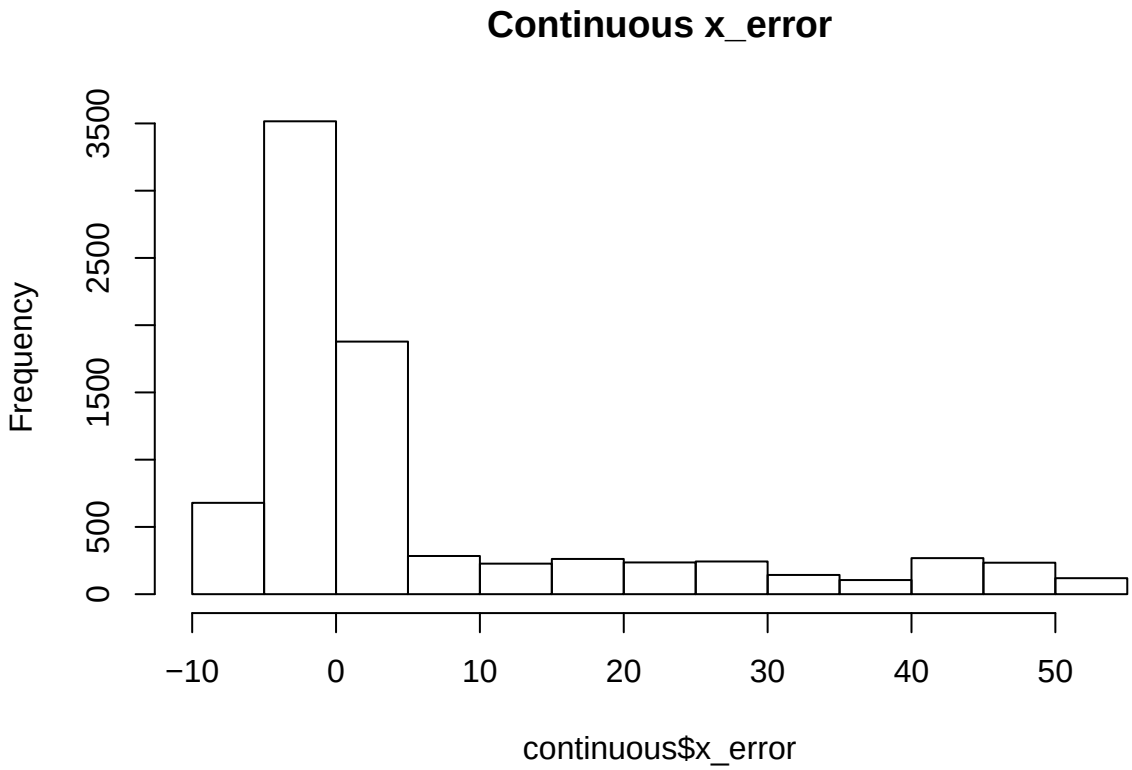
Shown below are plots representing the robot's motion and error over time.

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

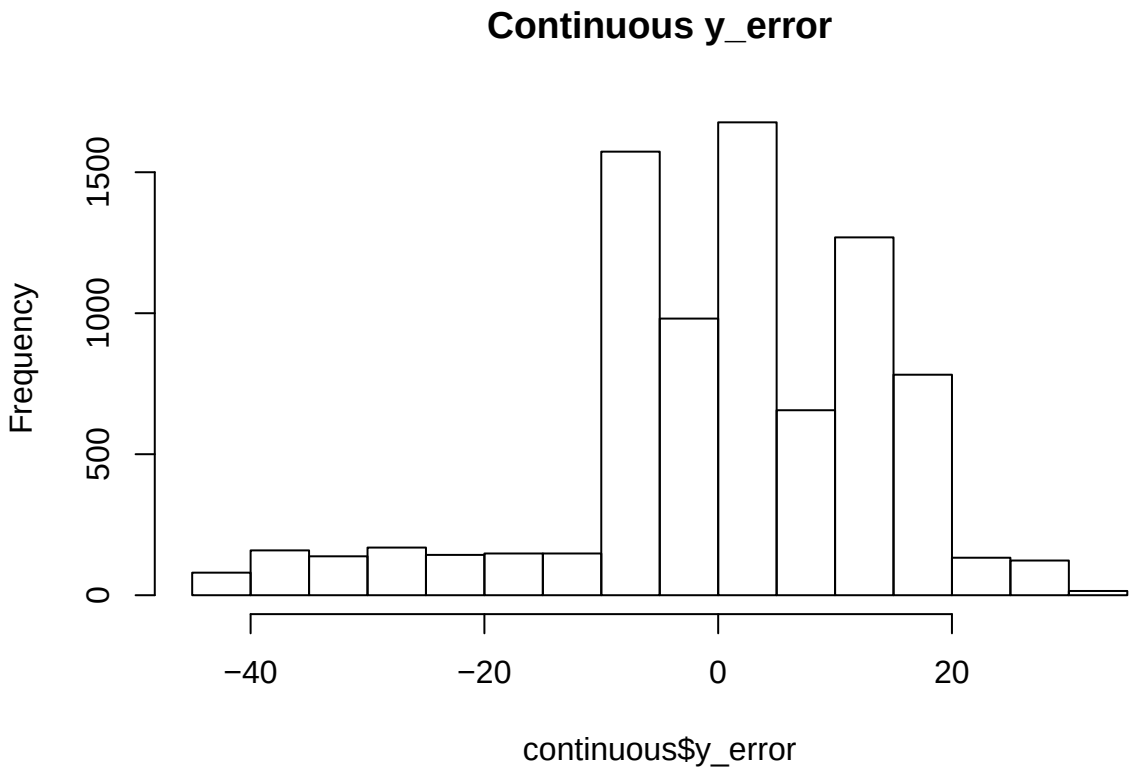



```r
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```

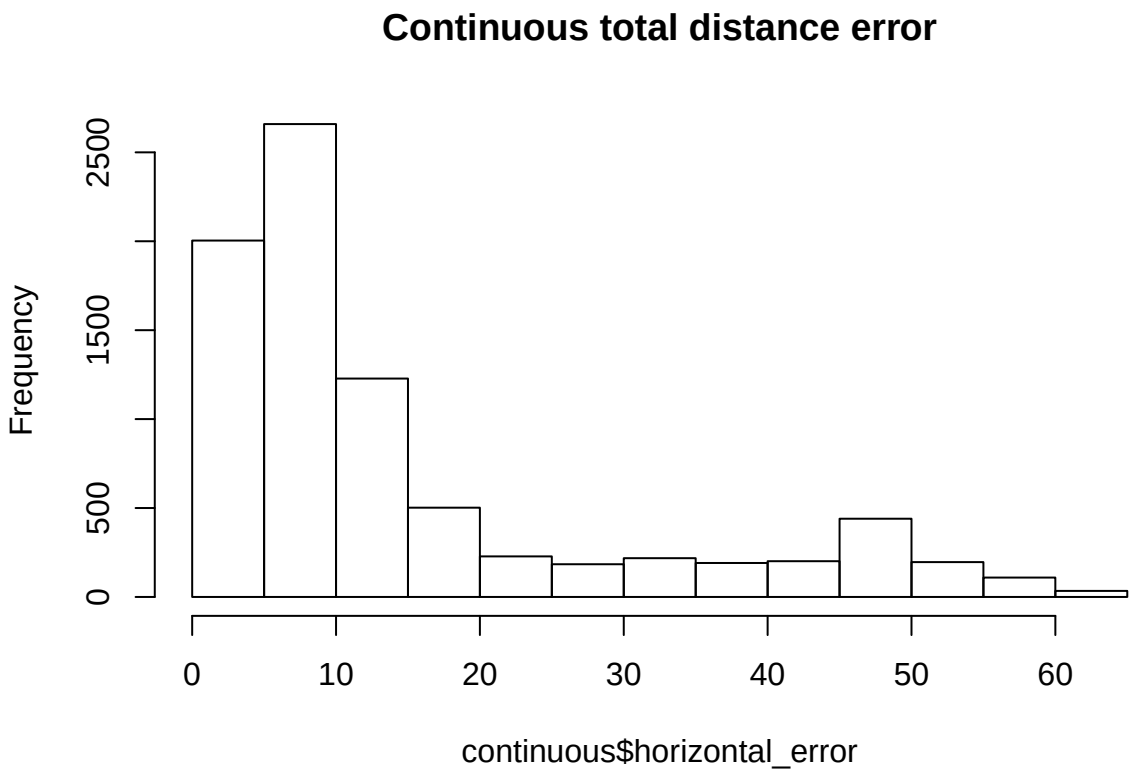
```r
hist(continuous$x_error,
     main = "Continuous x_error")
```



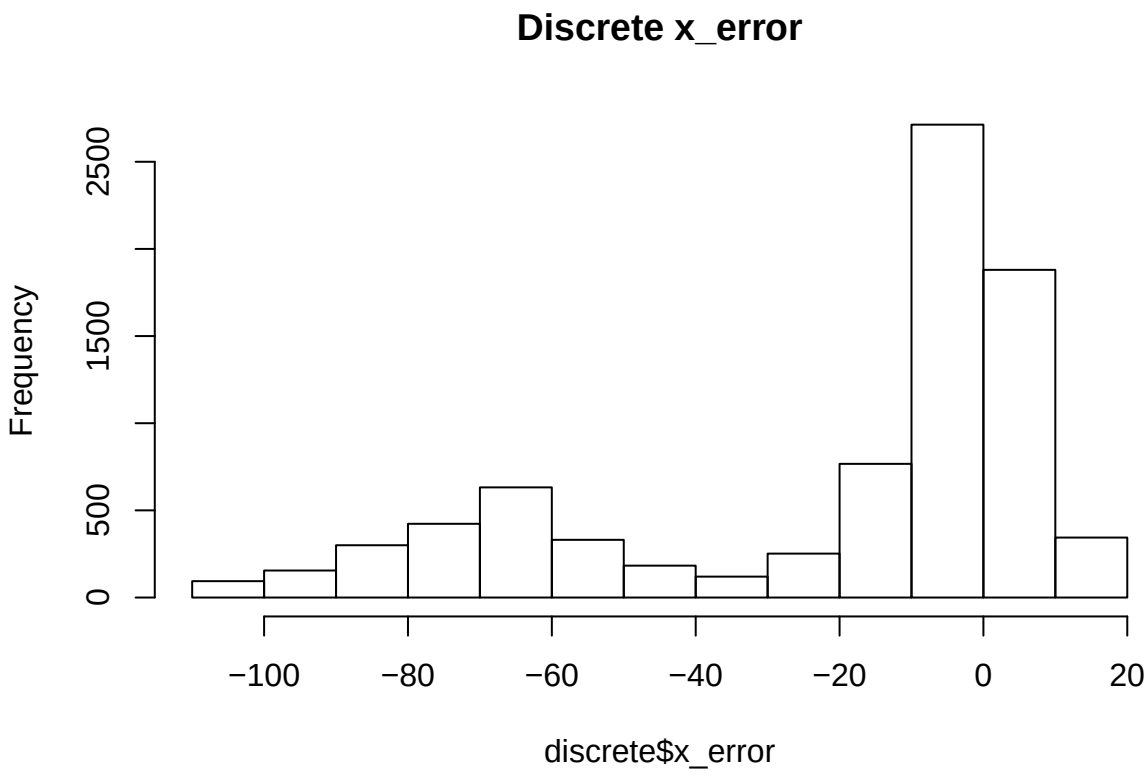

```r
hist(continuous$y_error,
      main = "Continuous y_error")
```



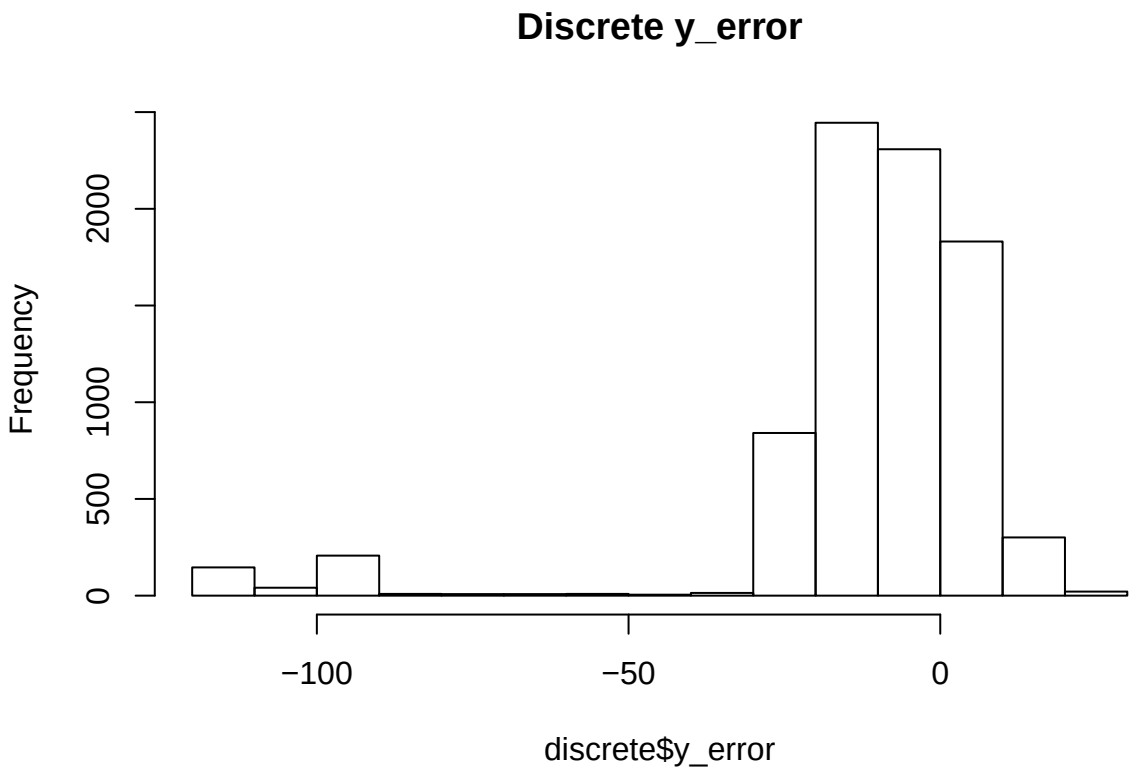
```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



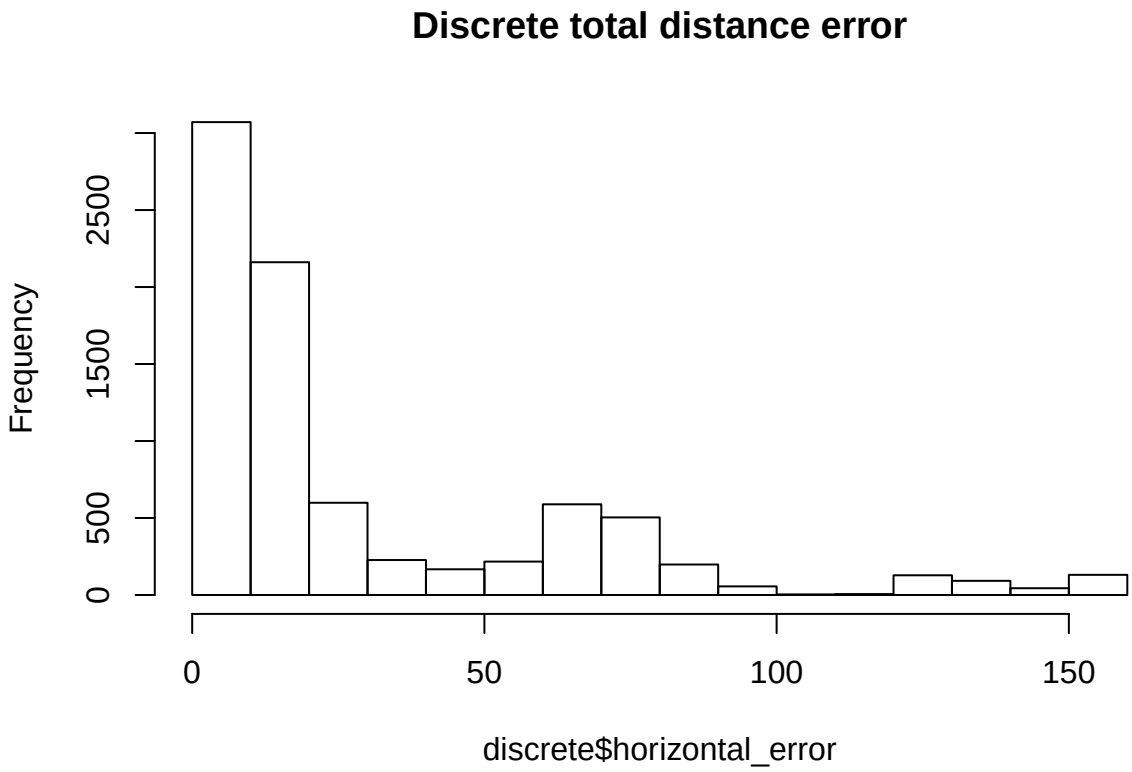

```r
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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 - 04:38:37 PM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for two-mobile Experiment}
##   \label{tab:two_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 & 8,194 & $-$10.078 & 16.495 & $-$59.243 & 4.125 \\
## y\_position & 8,194 & $-$1.830 & 13.798 & $-$35.825 & 41.278 \\
## yaw & 8,194 & $-$0.332 & 2.028 & $-$3.132 & 3.139 \\
## x\_variance & 8,194 & 23.982 & 27.657 & 0.078 & 105.047 \\
## y\_variance & 8,194 & 16.152 & 14.418 & 0.078 & 67.542 \\
## yaw\_variance & 8,194 & 25.998 & 27.416 & 0.093 & 104.459 \\
## yaw\_error & 8,194 & 0.073 & 1.791 & $-$3.141 & 3.141 \\
## x\_error & 8,194 & 5.983 & 15.040 & $-$8.825 & 53.659 \\
```

```
## y\_error & 8,194 & 1.044 & 13.567 & $-$43.554 & 30.941 \\
## horizontal\_error & 8,194 & 14.892 & 15.011 & 0.00001 & 61.941 \\
## \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 - 04:38:37 PM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for two-mobile Experiment}
##   \label{tab:two_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 & 8,194 & 16.684 & 29.052 & $-$15.324 & 94.853 \\
## y\_position & 8,194 & 11.565 & 21.866 & $-$29.624 & 114.437 \\
## yaw & 8,194 & $-$0.058 & 1.705 & $-$3.142 & 3.141 \\
## x\_variance & 8,194 & 0.503 & 0.572 & 0.0003 & 4.000 \\
## y\_variance & 8,194 & 0.581 & 0.890 & 0.0003 & 8.145 \\
## yaw\_variance & 8,194 & 0.819 & 0.982 & 0.089 & 4.527 \\
## x\_error & 8,194 & $-$20.780 & 31.348 & $-$103.701 & 16.224 \\
## y\_error & 8,194 & $-$12.352 & 23.153 & $-$117.017 & 27.349 \\
## horizontal\_error & 8,194 & 29.216 & 35.348 & 0.00002 & 156.355 \\
## yaw\_error & 8,194 & $-$0.132 & 1.642 & $-$3.140 & 3.141 \\
## \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)
}
```