two_mobile Experiment Report

Matthew Swartwout

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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.
## -3.0780000 -0.8695000  0.0003396 -0.4258000  0.0080780  1.0110000
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.0380000 -1.6510000  0.0000001 -0.7605000  0.0000222  2.0160000
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.1360000 -2.6280000  0.0006796 -1.1620000  0.0057330  3.1330000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.000016 0.007742 0.648500 0.921600 1.866000 3.487000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -3.36800 -0.52410 -0.01672 -0.07019  0.41410  2.74300
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -4.07100 -0.39600 -0.03705 -0.01092  0.40320  2.71400
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.1410000  0.0000089  0.0000298 -0.0108500  0.0000573  3.1410000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.000016 0.458400 0.820300 0.953600 1.292000 4.213000
```
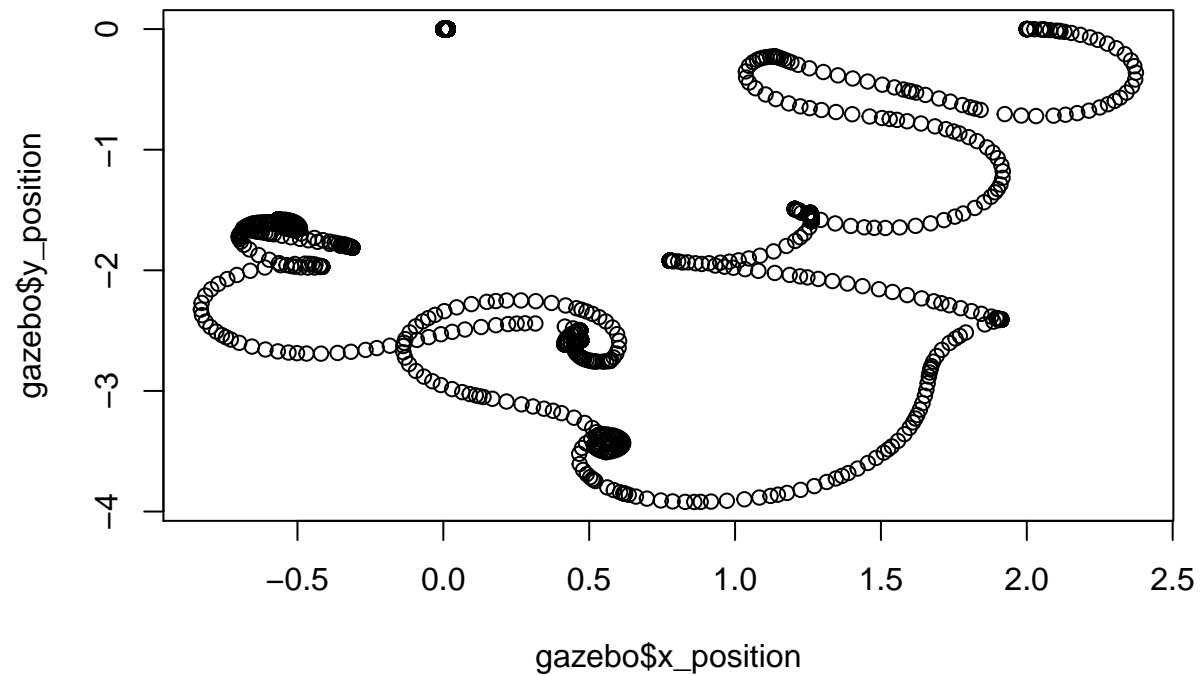
```
if (params$robot >= 2) {
    summary(external_data_averages)
}
```

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

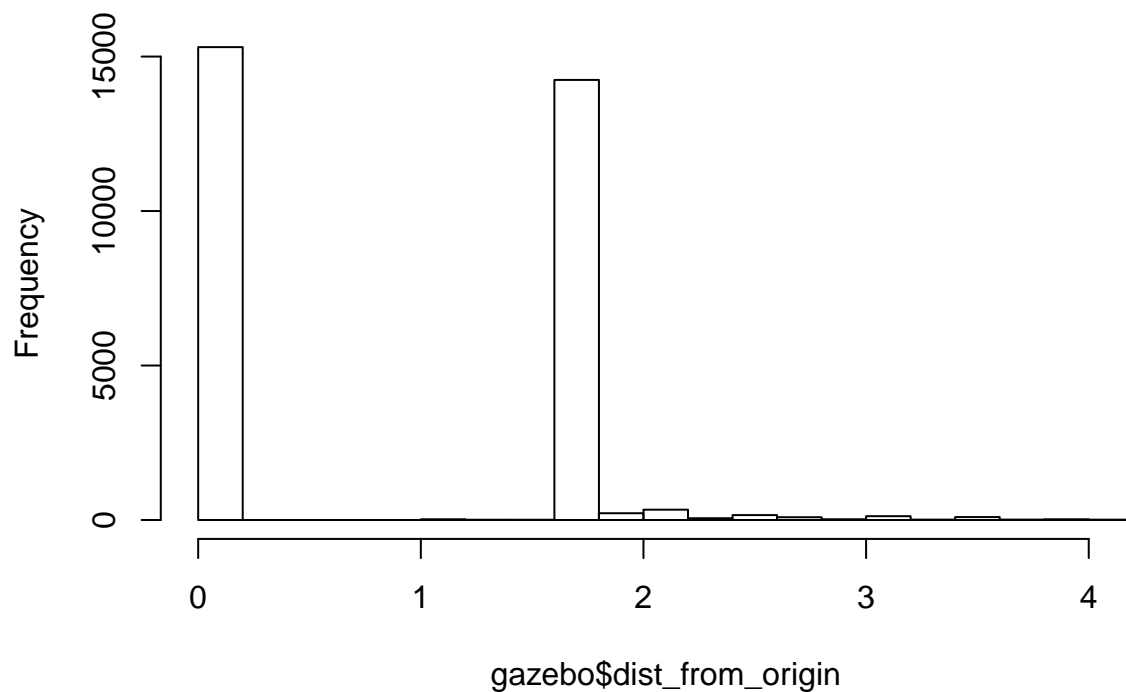Shown below are plots representing the robot's motion and error over time.

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

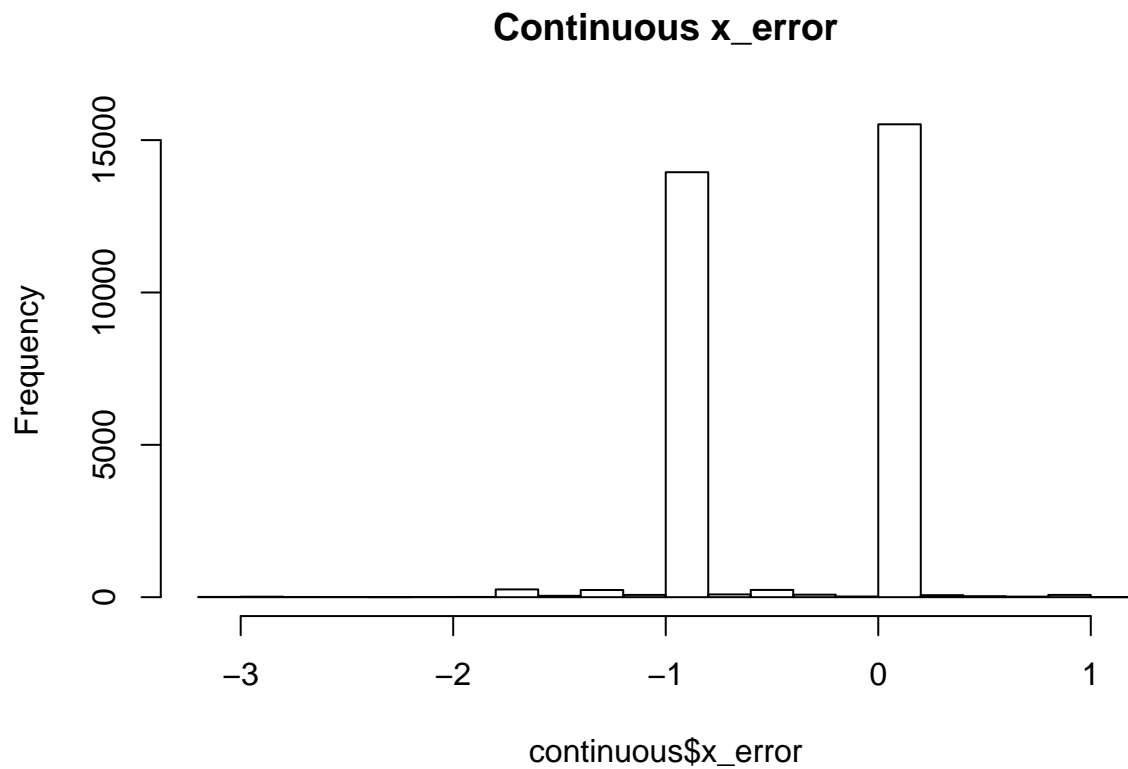**Ground truth visited locations of robots**


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

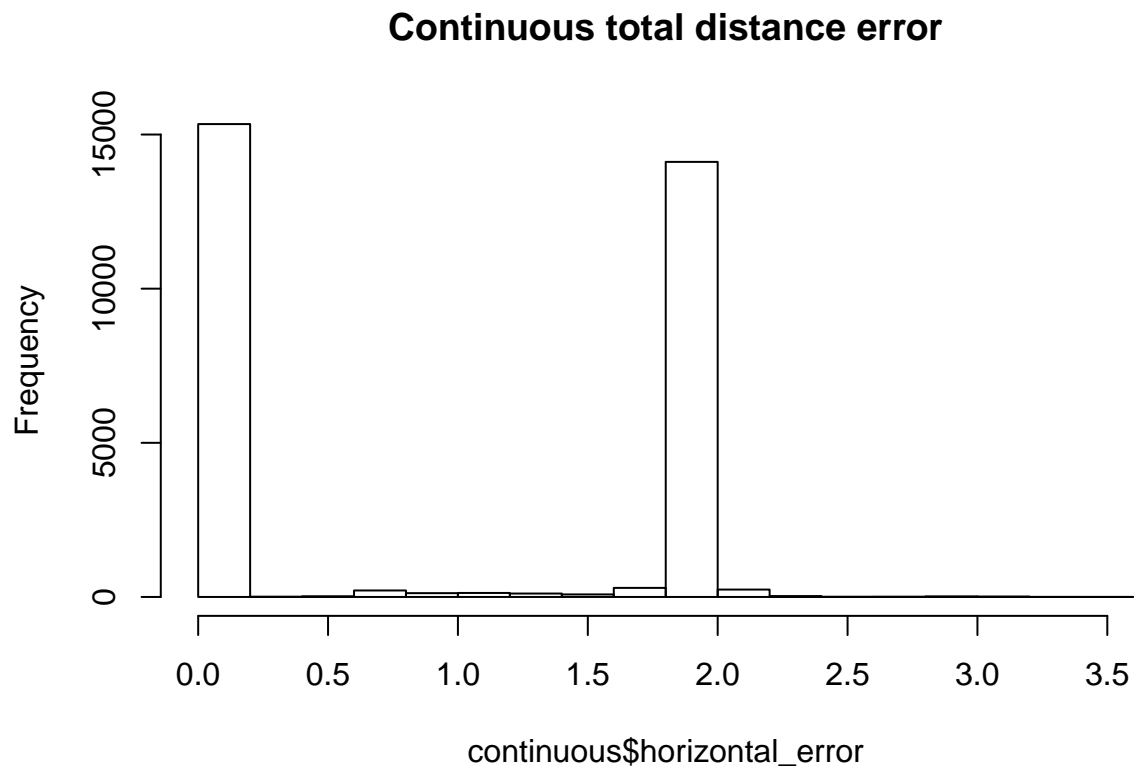**Distance from origin vs. time**

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

Continuous x_error

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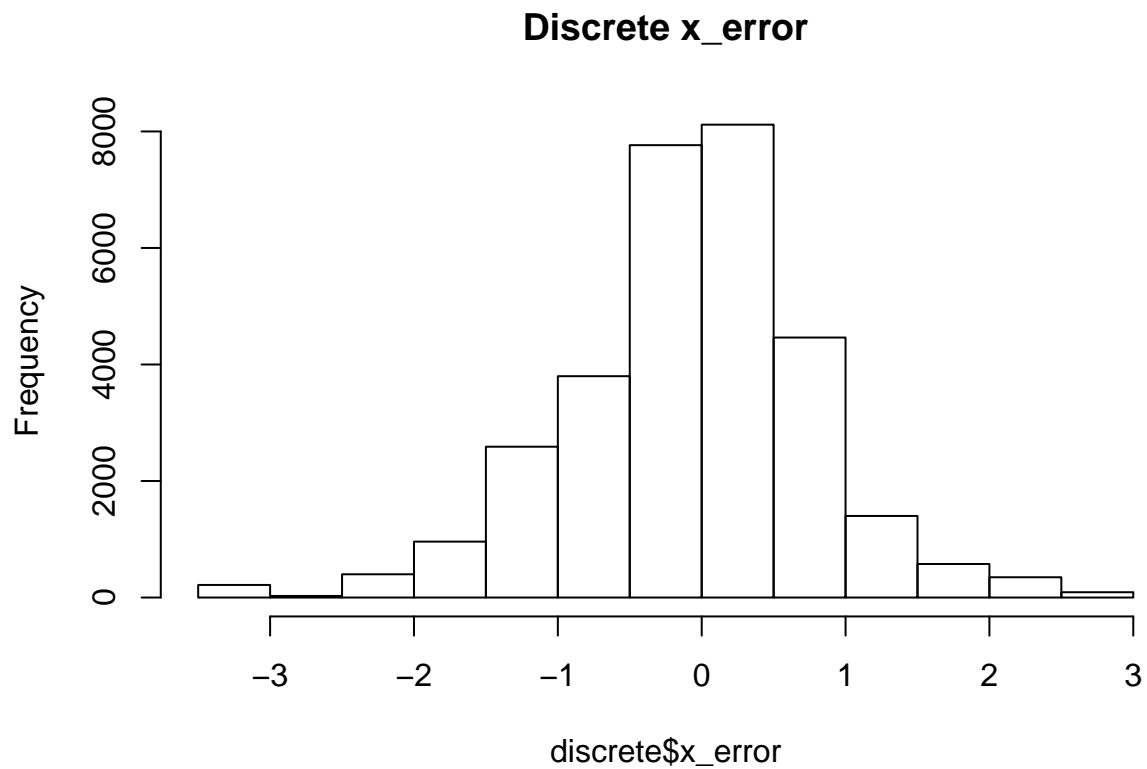
```r
hist(continuous$y_error,
     main = "Continuous y_error")
```

Continuous y_error

continuous$y_error

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

Continuous total distance error


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

Discrete x_error

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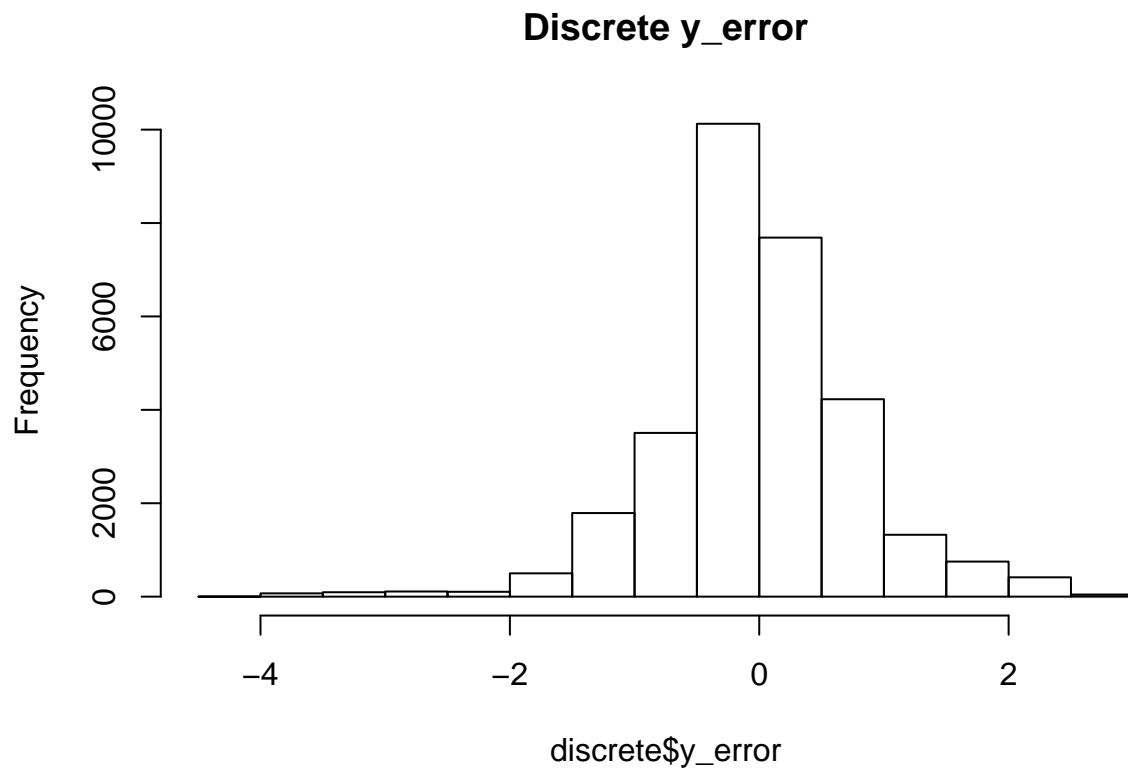
Discrete y_error


```r
hist (discrete$horizontal_error,
      main = "Discrete total distance error")
```

Discrete total distance error
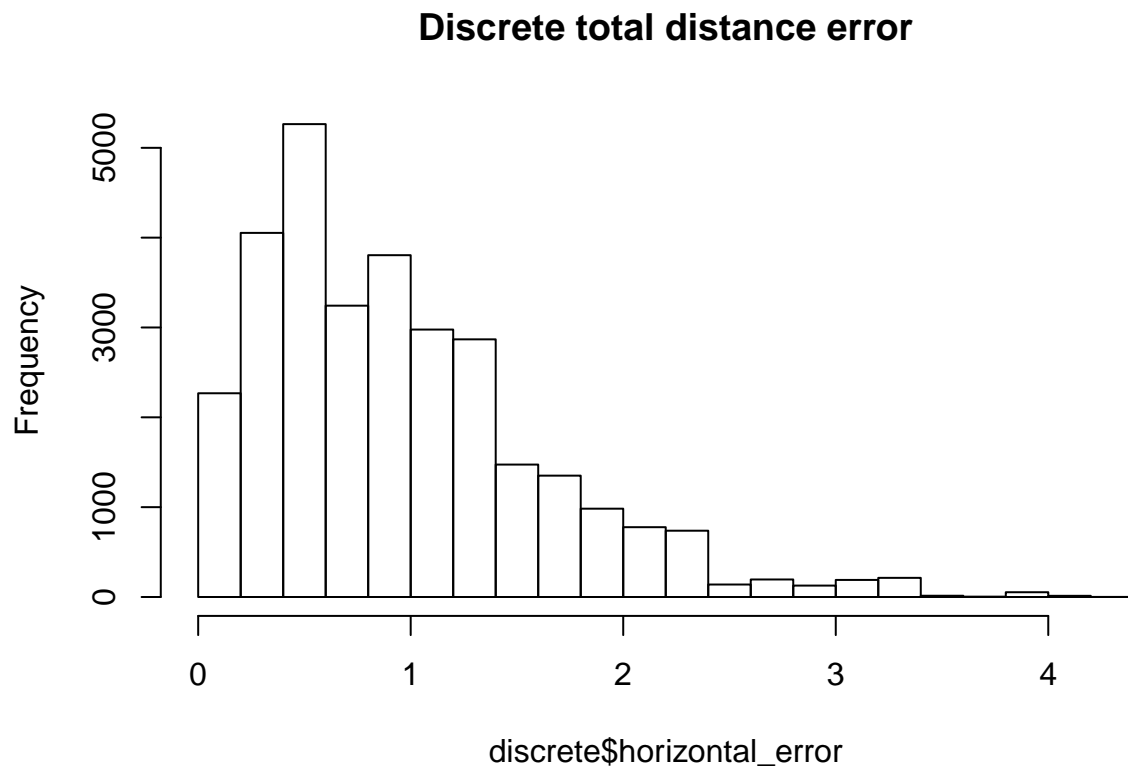
```r
figure_dir <- "/home/matt/thesis/writing/r_figures/"
filename = paste0(figure_dir, params$experiment, "_continuous_error.pdf")
pdf(filename)
plot(continuous$horizontal_error, main="Continuous Filter Error", sub=paste0("For ", params$experiment,

dev.off()
```

```
## pdf
##   2
```

```r
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
```

```r
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()
}
```

```r
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, " Experiment
          digits.extra = 20)
```

```
##
## % Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard
## % Date and time: Mon, Aug 15, 2016 - 10:04:41 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.} & \multic
## \hline \\[-1.8ex]
## x\_position & 30,750 & 0.191 & 0.357 & $-$0.494 & 4.130 \\
## y\_position & 30,750 & $-$0.064 & 0.493 & $-$4.499 & 1.383 \\
## yaw & 30,750 & 1.301 & 1.488 & $-$3.122 & 3.123 \\
## x\_variance & 30,750 & 45.139 & 25.988 & 0.084 & 90.155 \\
## y\_variance & 30,750 & 45.741 & 26.084 & 0.084 & 91.442 \\
## yaw\_variance & 30,750 & 54.407 & 31.199 & 0.101 & 108.692 \\
## yaw\_error & 30,750 & $-$1.162 & 1.388 & $-$3.136 & 3.133 \\
## x\_error & 30,750 & $-$0.426 & 0.471 & $-$3.078 & 1.011 \\
```

```
## y\_error & 30,750 & $-$0.760 & 0.849 & $-$3.038 & 2.016 \\
## horizontal\_error & 30,750 & 0.922 & 0.923 & 0.00002 & 3.487 \\
## \hline \\[-1.8ex]
## \end{tabular}
## \end{table}
```

```r
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.harvard
## % Date and time: Mon, Aug 15, 2016 - 10:04:41 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 & 30,750 & $-$0.164 & 1.008 & $-$3.112 & 4.145 \\
## y\_position & 30,750 & $-$0.813 & 1.182 & $-$5.443 & 3.951 \\
## yaw & 30,750 & 0.084 & 0.398 & $-$3.141 & 3.058 \\
## x\_variance & 30,750 & 1.360 & 0.355 & 0.0002 & 2.569 \\
## y\_variance & 30,750 & 1.362 & 0.360 & 0.0002 & 4.066 \\
## yaw\_variance & 30,750 & 0.392 & 0.177 & 0.090 & 2.186 \\
## x\_error & 30,750 & $-$0.070 & 0.857 & $-$3.368 & 2.743 \\
## y\_error & 30,750 & $-$0.011 & 0.781 & $-$4.071 & 2.714 \\
## horizontal\_error & 30,750 & 0.954 & 0.663 & 0.00002 & 4.213 \\
## yaw\_error & 30,750 & $-$0.011 & 0.389 & $-$3.141 & 3.141 \\
## \hline \\[-1.8ex]
## \end{tabular}
## \end{table}
```

```r
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)
}
```