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.
## -10.2900  -7.4220  -0.8070  -0.7382   4.4380  11.8300
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -0.8902  3.8290  7.3290  6.3780  8.9700 12.6500
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -3.14100 -1.60600 -0.01283  0.01432  1.64800  3.14000
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
##  0.000013  7.176000  9.807000  8.992000 12.090000 13.870000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -16.2700  -3.8930  -0.2219  -0.5752   0.8692  28.6200
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -10.9400   0.1257   2.0940   3.8780   6.0900  26.8600
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -3.1410 -1.3760 -0.5079 -0.2810  0.7765  3.1390
```

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

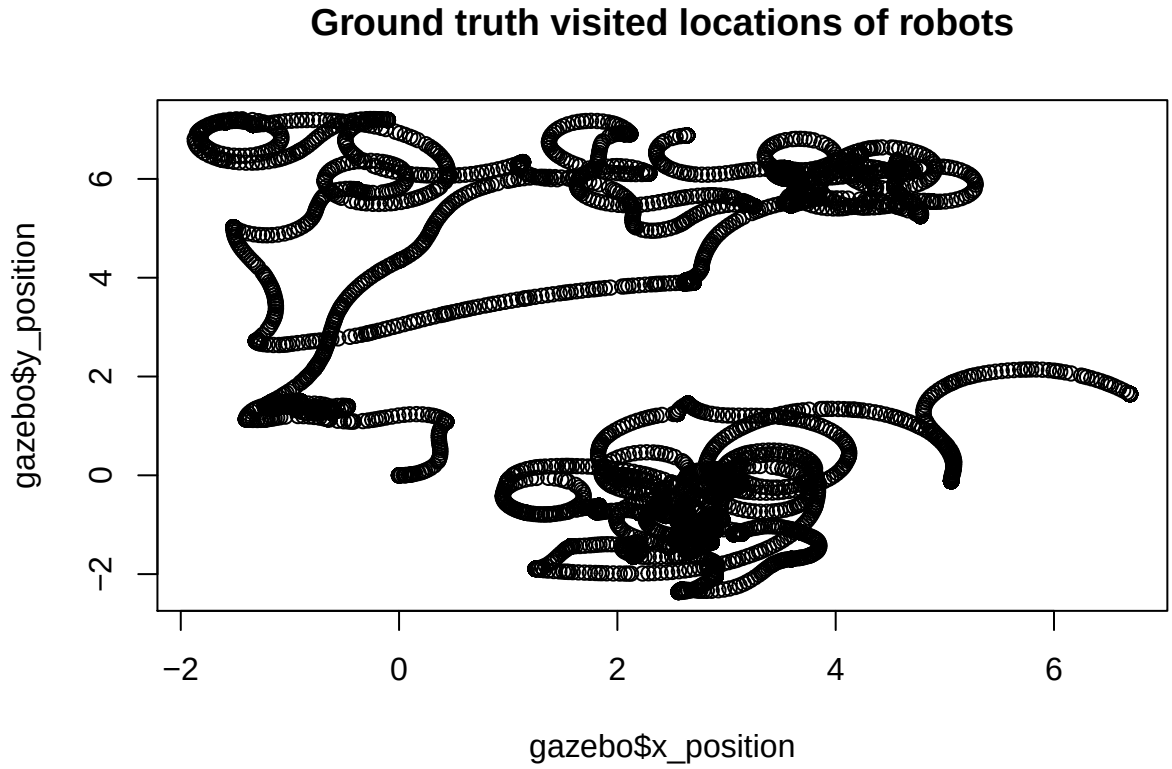
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
##  0.000013  1.505000  4.326000  6.992000 10.940000 31.060000
```

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

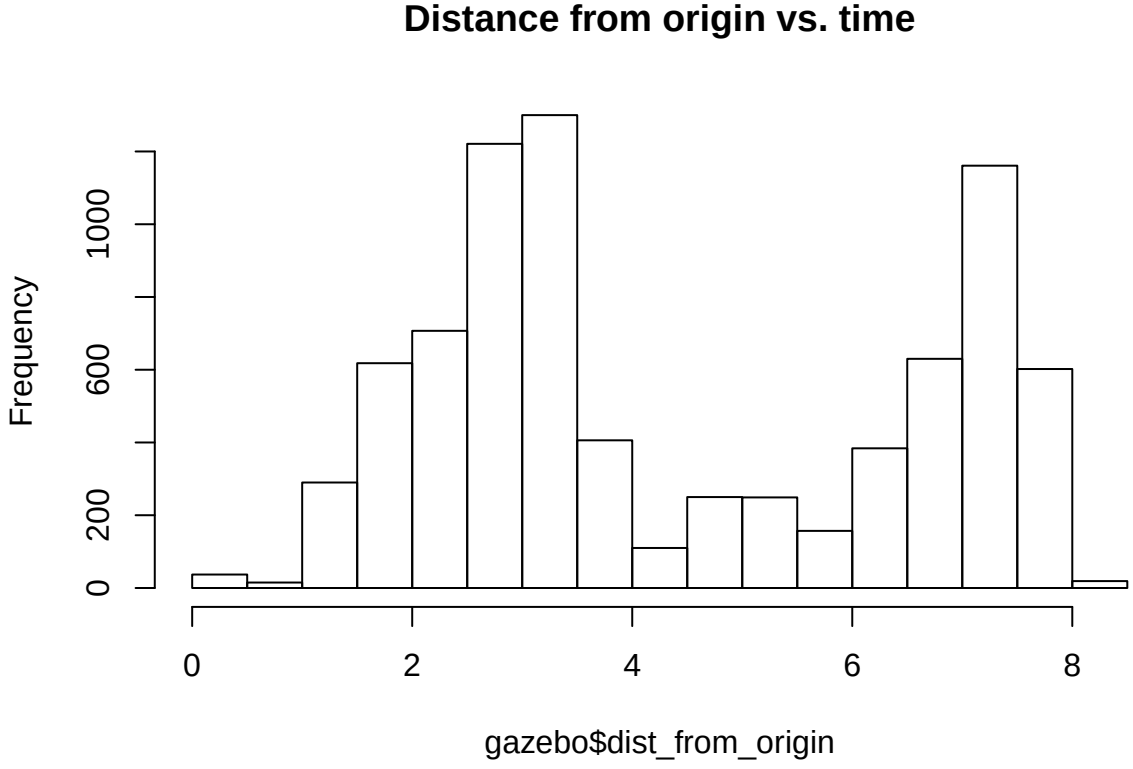
```
##      Length Class  Mode
## [1,] 1      -none- numeric
## [2,] 1      -none- numeric
```

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")
```

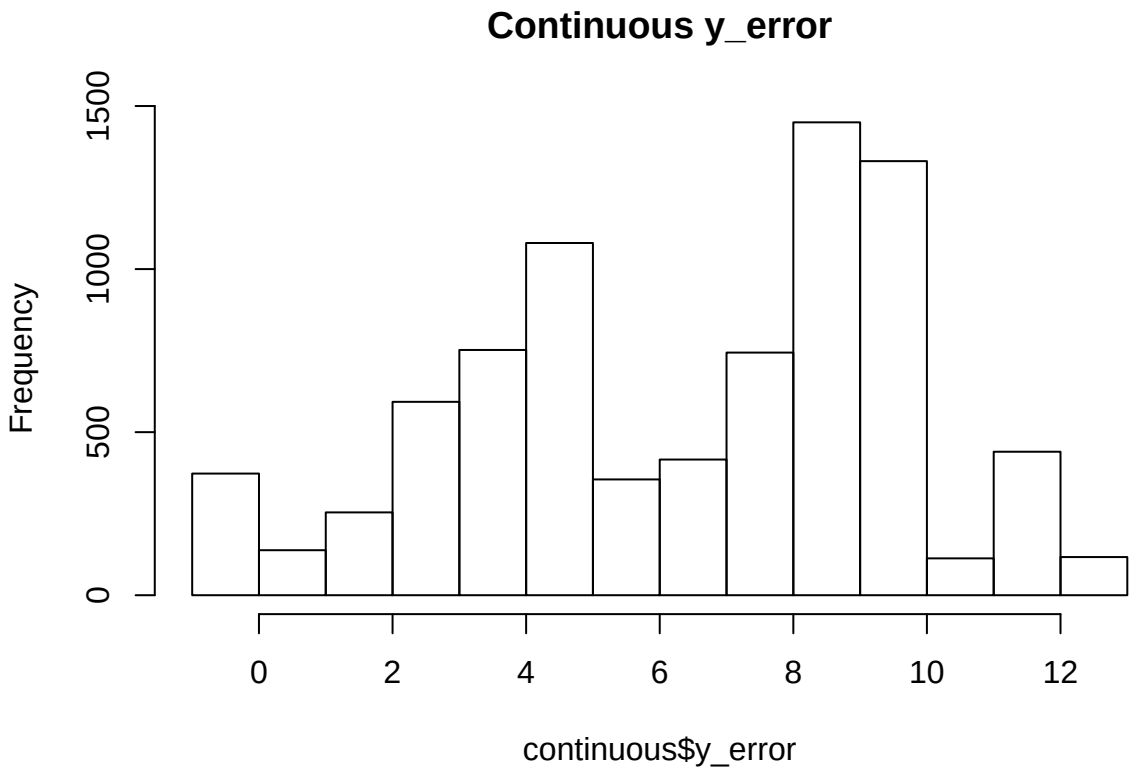



```r
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```

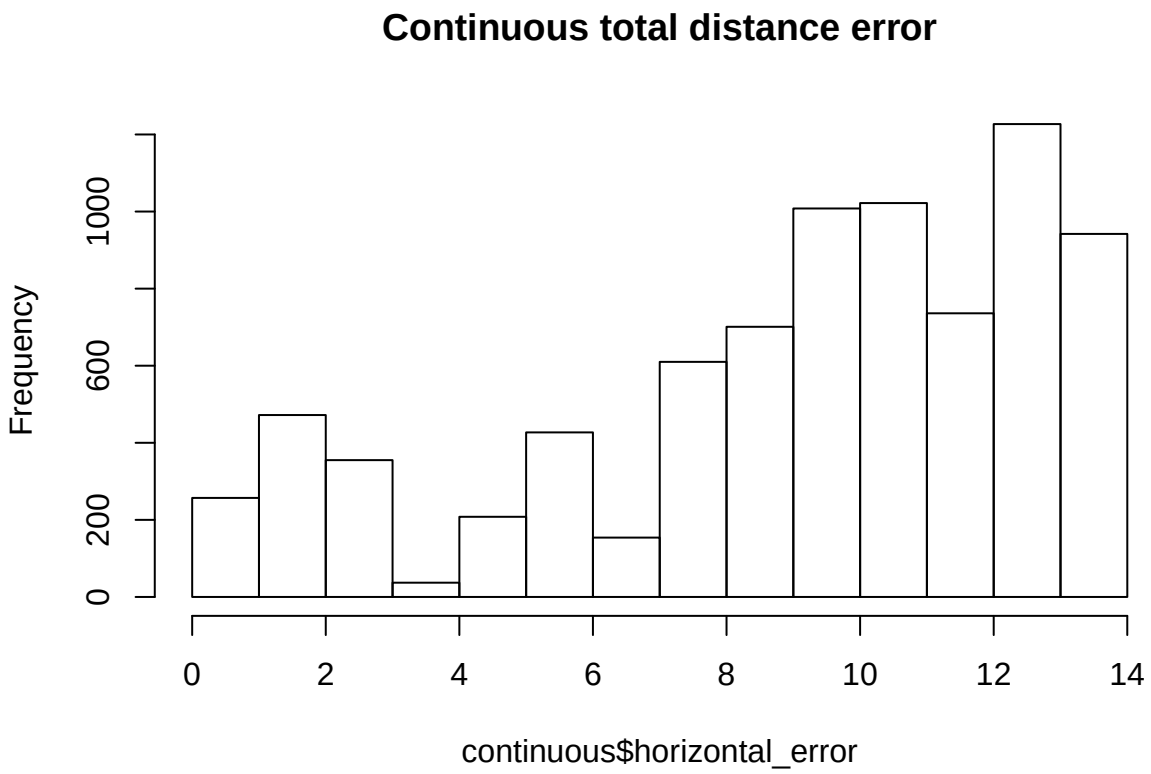


```r
hist(continuous$x_error,
     main = "Continuous x_error")
```

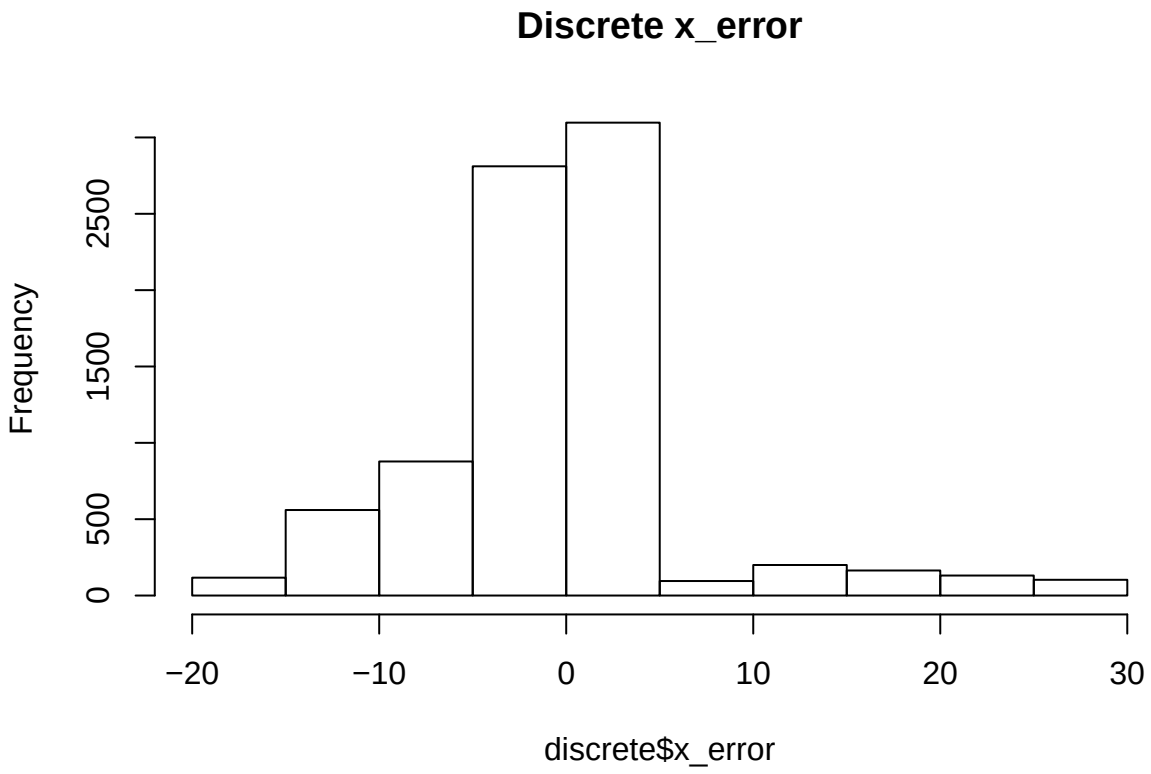

```r
hist(continuous$y_error,
      main = "Continuous y_error")
```



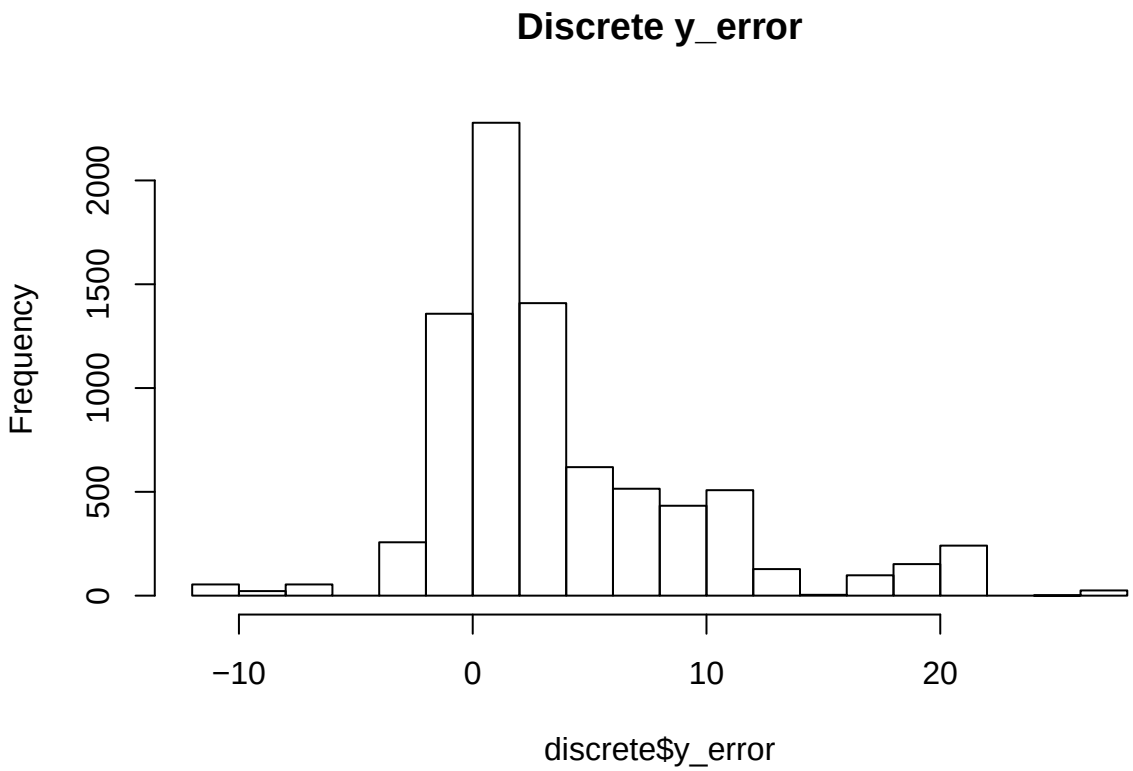
```
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



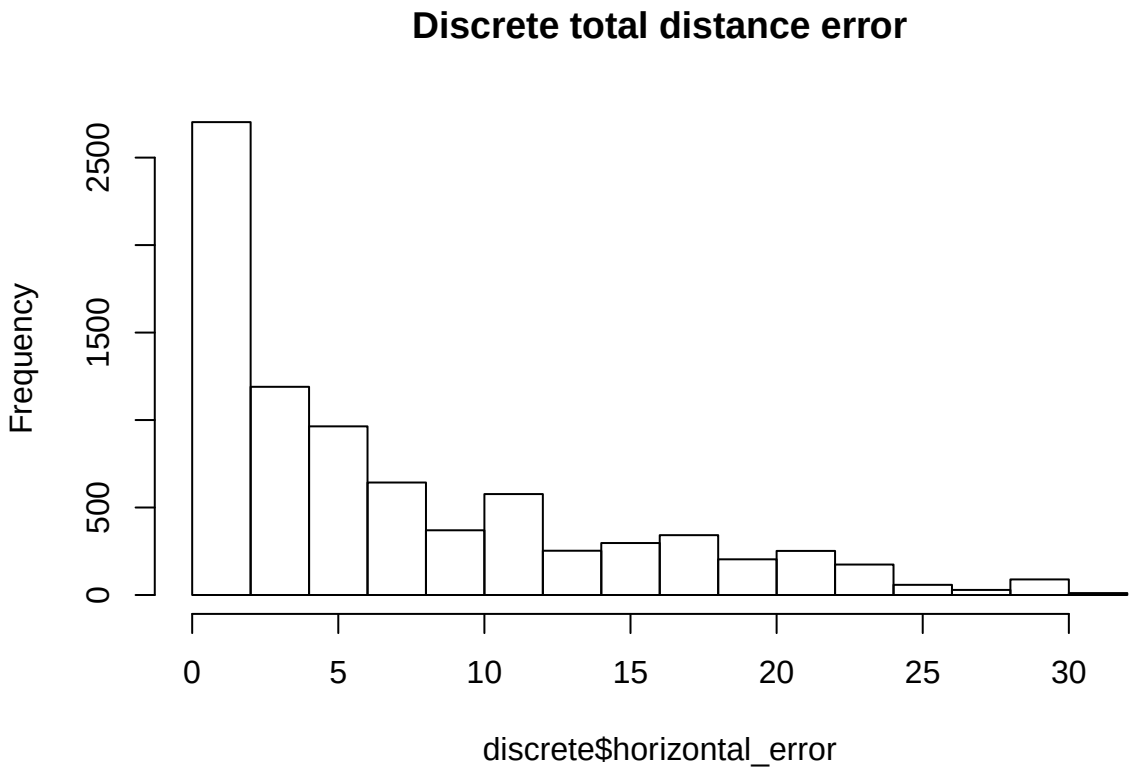

```
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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: Mon, Aug 15, 2016 - 04:02:35 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 & 8,156 & 3.076 & 6.333 & $-$7.598 & 12.948 \\
## y\_position & 8,156 & $-$4.208 & 4.936 & $-$11.488 & 4.182 \\
## yaw & 8,156 & 0.210 & 1.768 & $-$3.137 & 3.141 \\
## x\_variance & 8,156 & 12.337 & 7.146 & 0.074 & 24.890 \\
## y\_variance & 8,156 & 12.213 & 7.032 & 0.074 & 24.438 \\
## yaw\_variance & 8,156 & 14.725 & 8.497 & 0.089 & 29.538 \\
## yaw\_error & 8,156 & 0.014 & 1.842 & $-$3.141 & 3.140 \\
## x\_error & 8,156 & $-$0.738 & 6.548 & $-$10.294 & 11.832 \\
```

```
## y\_error & 8,156 & 6.378 & 3.281 & $-$0.890 & 12.651 \\
## horizontal\_error & 8,156 & 8.992 & 3.743 & 0.00001 & 13.870 \\
## \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 - 04:02:35 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 & 8,156 & 2.913 & 6.592 & $-$24.423 & 16.989 \\
## y\_position & 8,156 & $-$1.708 & 6.107 & $-$25.500 & 10.996 \\
## yaw & 8,156 & $-$0.180 & 1.800 & $-$3.135 & 3.138 \\
## x\_variance & 8,156 & 0.844 & 0.570 & 0.0004 & 2.511 \\
## y\_variance & 8,156 & 0.847 & 0.578 & 0.0004 & 3.791 \\
## yaw\_variance & 8,156 & 0.399 & 0.183 & 0.088 & 1.450 \\
## x\_error & 8,156 & $-$0.575 & 7.038 & $-$16.272 & 28.621 \\
## y\_error & 8,156 & 3.878 & 5.805 & $-$10.942 & 26.862 \\
## horizontal\_error & 8,156 & 6.992 & 7.051 & 0.00001 & 31.062 \\
## yaw\_error & 8,156 & $-$0.281 & 1.614 & $-$3.141 & 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)
}
```