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.
## -3.7770 -2.7790 -0.3373 -1.1170  0.1645  1.3300
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -3.12300 -0.64650  0.05925  0.87640  2.61800  6.50700
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -3.14100 -1.45300 -0.05671 -0.04461  1.30600  3.14000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.000015 0.872700 2.208000 2.481000 4.340000 6.508000
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -4.00700 -1.57000 -0.01663 -0.58890  0.41010  2.04100
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -4.5140 -1.4330 -0.8844 -0.9139 -0.2637  0.8239
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -3.1340 -1.3410 -0.5272 -0.3884  0.4383  3.1260
```

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

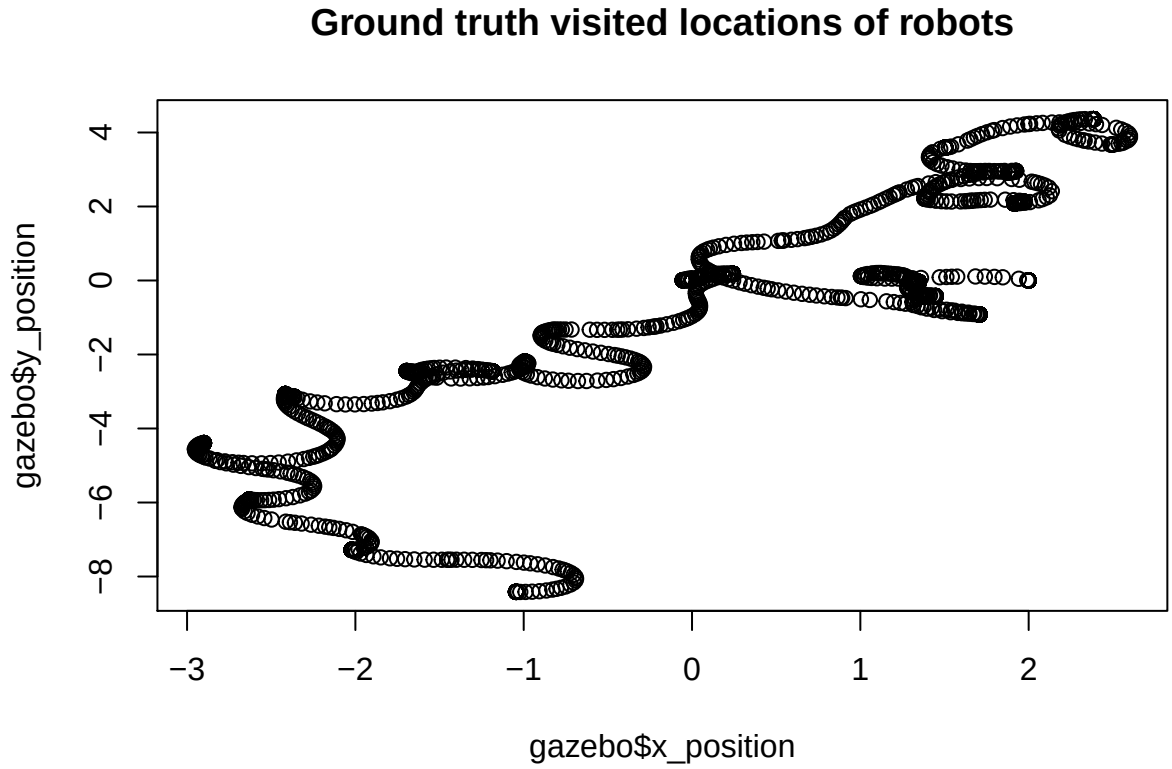
```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## 0.000015 0.792800 1.323000 1.619000 2.239000 4.853000
```

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

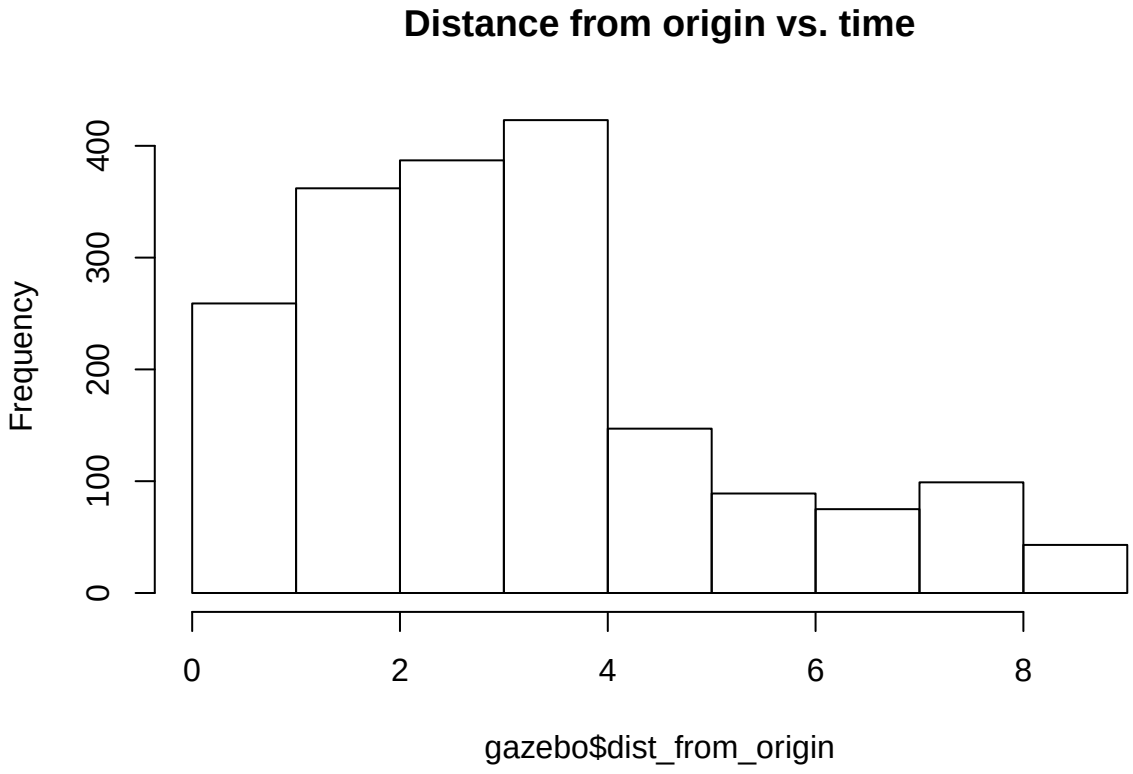
```
##      Length Class  Mode
## [1,] 1      -none- numeric
## [2,] 1      -none- numeric
```

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

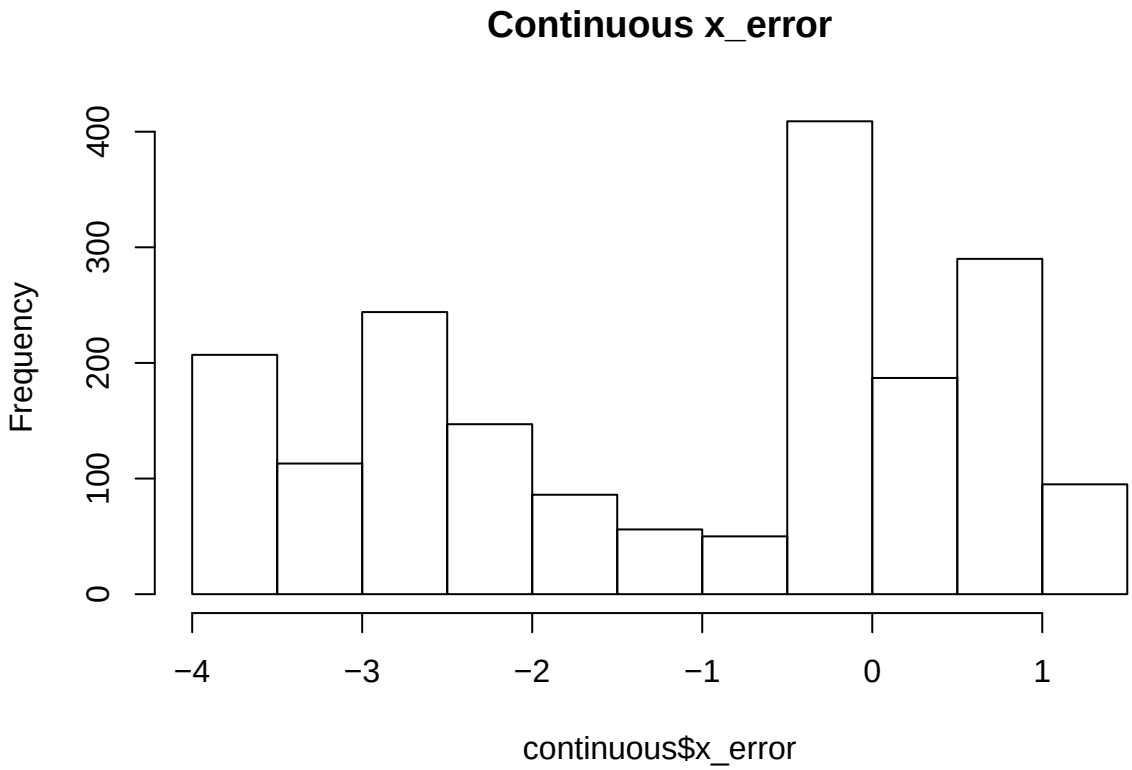
```r
plot(gazebo$x_position, gazebo$y_position,
     main = "Ground truth visited locations of robots")
```




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

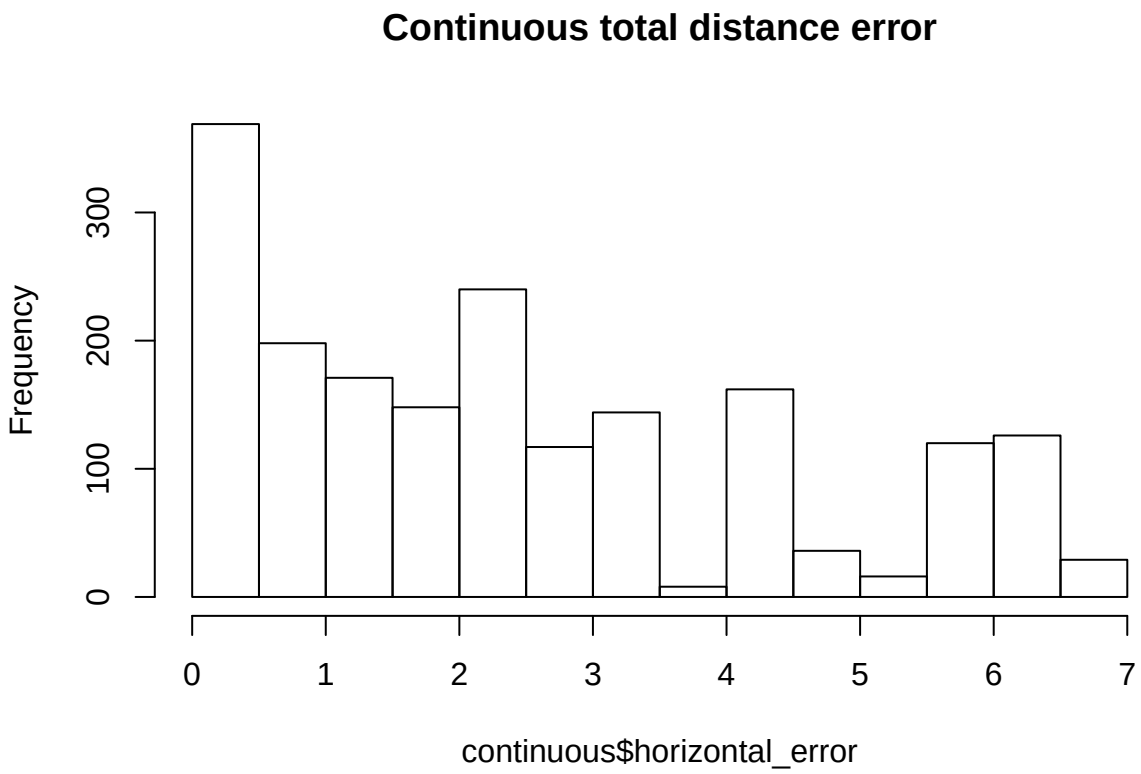


```r
hist(continuous$x_error,
     main = "Continuous x_error")
```

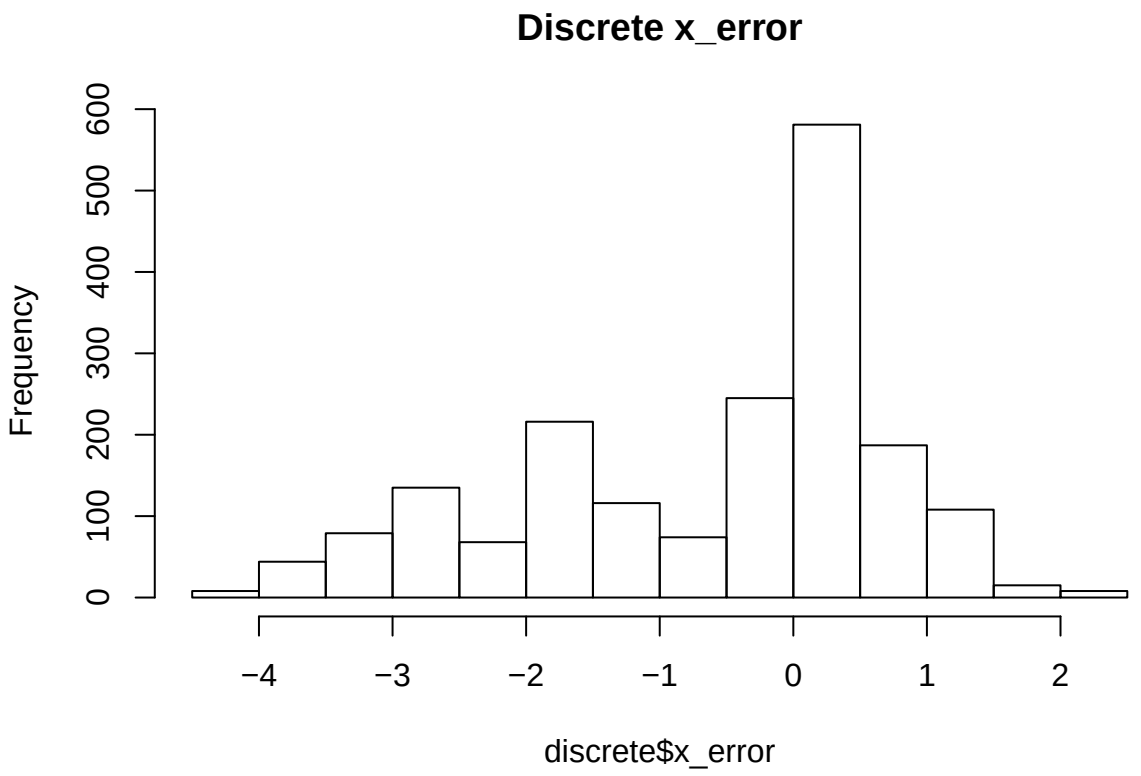



```r
hist(continuous$y_error,
      main = "Continuous y_error")
```

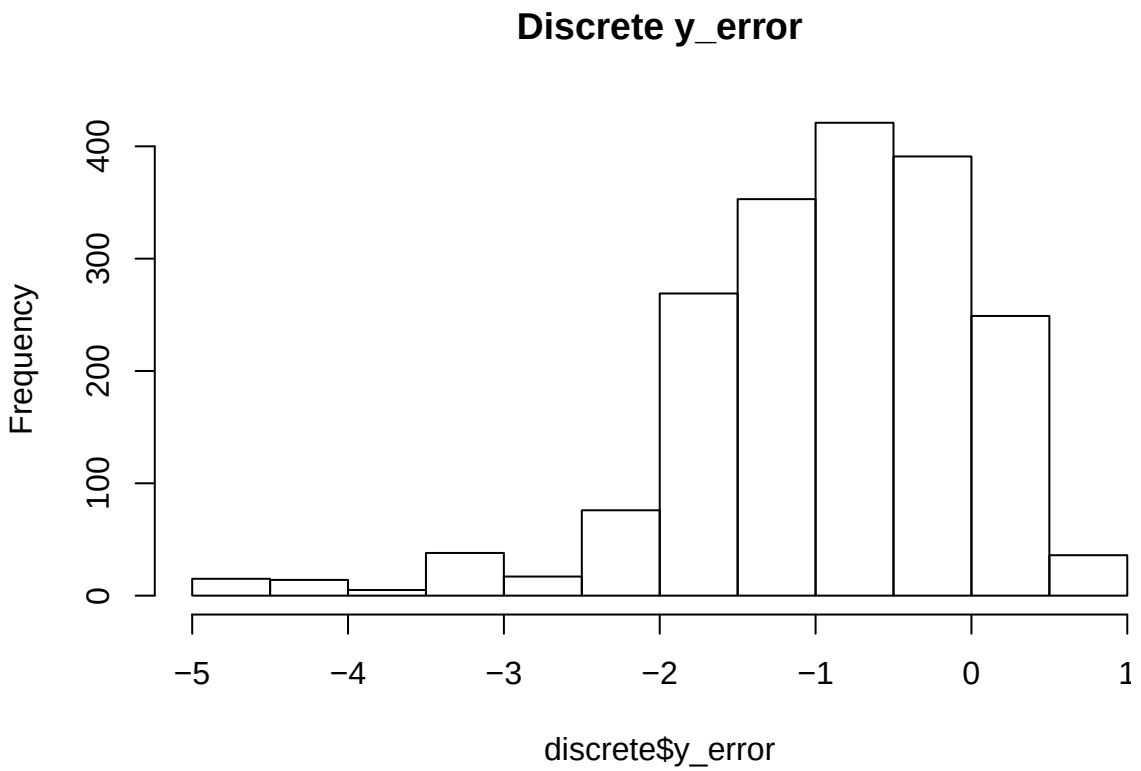
```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



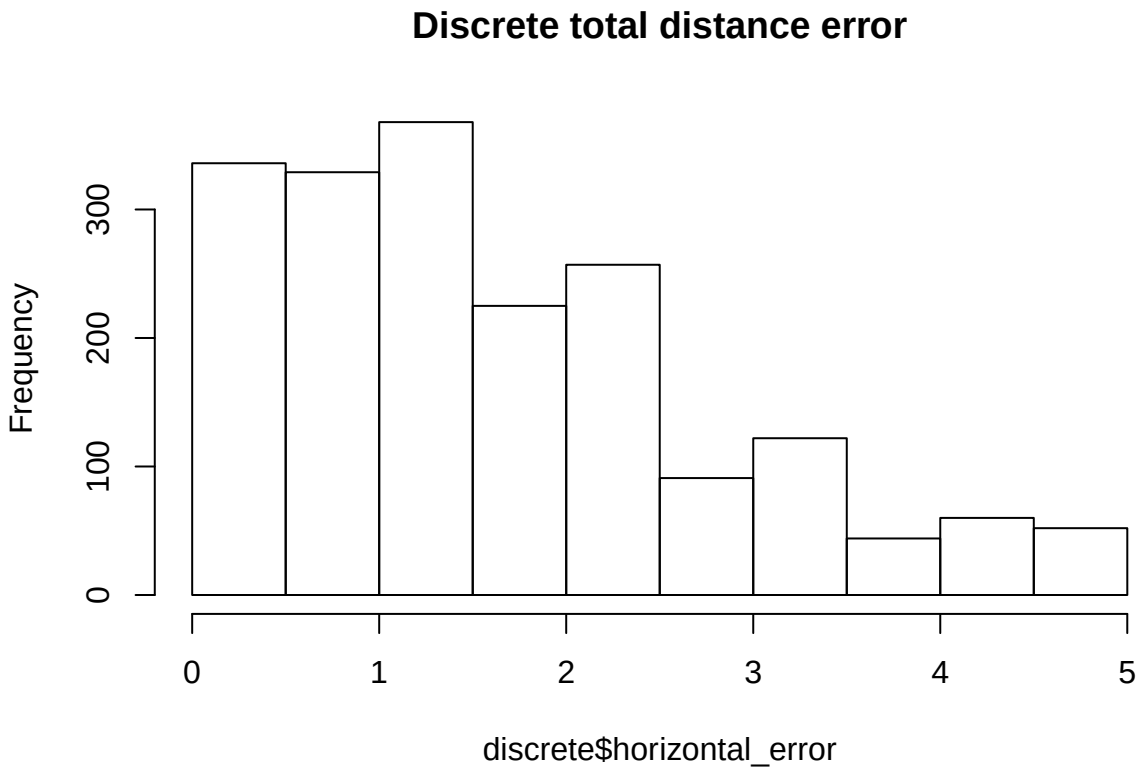

```r
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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: Mon, Aug 15, 2016 - 04:26:52 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 & 1,884 & 1.104 & 2.492 & $-$3.542 & 5.544 \\
## y\_position & 1,884 & $-$1.873 & 2.250 & $-$7.018 & 1.099 \\
## yaw & 1,884 & $-$0.325 & 1.784 & $-$3.140 & 3.129 \\
## x\_variance & 1,884 & 3.185 & 1.805 & 0.079 & 6.423 \\
## y\_variance & 1,884 & 3.289 & 1.933 & 0.079 & 6.819 \\
## yaw\_variance & 1,884 & 3.851 & 2.208 & 0.095 & 7.831 \\
## yaw\_error & 1,884 & $-$0.045 & 1.765 & $-$3.141 & 3.140 \\
## x\_error & 1,884 & $-$1.117 & 1.598 & $-$3.777 & 1.330 \\
```

```
## y\_error & 1,884 & 0.876 & 2.346 & $-$3.123 & 6.507 \\
## horizontal\_error & 1,884 & 2.481 & 1.978 & 0.00002 & 6.508 \\
## \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 - 04:26:53 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 & 1,884 & 0.577 & 1.282 & $-$3.250 & 4.213 \\
## y\_position & 1,884 & $-$0.083 & 2.853 & $-$7.289 & 4.911 \\
## yaw & 1,884 & 0.386 & 1.642 & $-$3.135 & 3.123 \\
## x\_variance & 1,884 & 0.865 & 0.680 & 0.001 & 4.046 \\
## y\_variance & 1,884 & 0.804 & 0.579 & 0.001 & 1.802 \\
## yaw\_variance & 1,884 & 0.408 & 0.224 & 0.090 & 2.076 \\
## x\_error & 1,884 & $-$0.589 & 1.370 & $-$4.007 & 2.041 \\
## y\_error & 1,884 & $-$0.914 & 0.946 & $-$4.514 & 0.824 \\
## horizontal\_error & 1,884 & 1.619 & 1.155 & 0.00002 & 4.853 \\
## yaw\_error & 1,884 & $-$0.388 & 1.441 & $-$3.134 & 3.126 \\
## \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)
}
```