two_mobile_no_gps Experiment Report

Matthew Swartwout

August 10, 2016

This is a summary of the data from the two_mobile_no_gps 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.
## -171.80000 -111.40000  -68.34000  -70.09000  -25.73000    0.00004
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -107.70000  -69.44000  -41.53000  -43.01000  -15.41000    0.07053
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -3.141000 -1.532000  0.002734  0.010080  1.551000  3.141000
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
##   0.00001  30.05000  81.74000  82.51000 133.70000 193.20000
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -619.4000 -484.8000 -348.8000 -342.7000 -212.8000    0.2716
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -159.90 -118.50  -78.10  -78.27  -37.13    0.00
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -3.141000 -1.527000  0.007707  0.019240  1.559000  3.141000
```

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

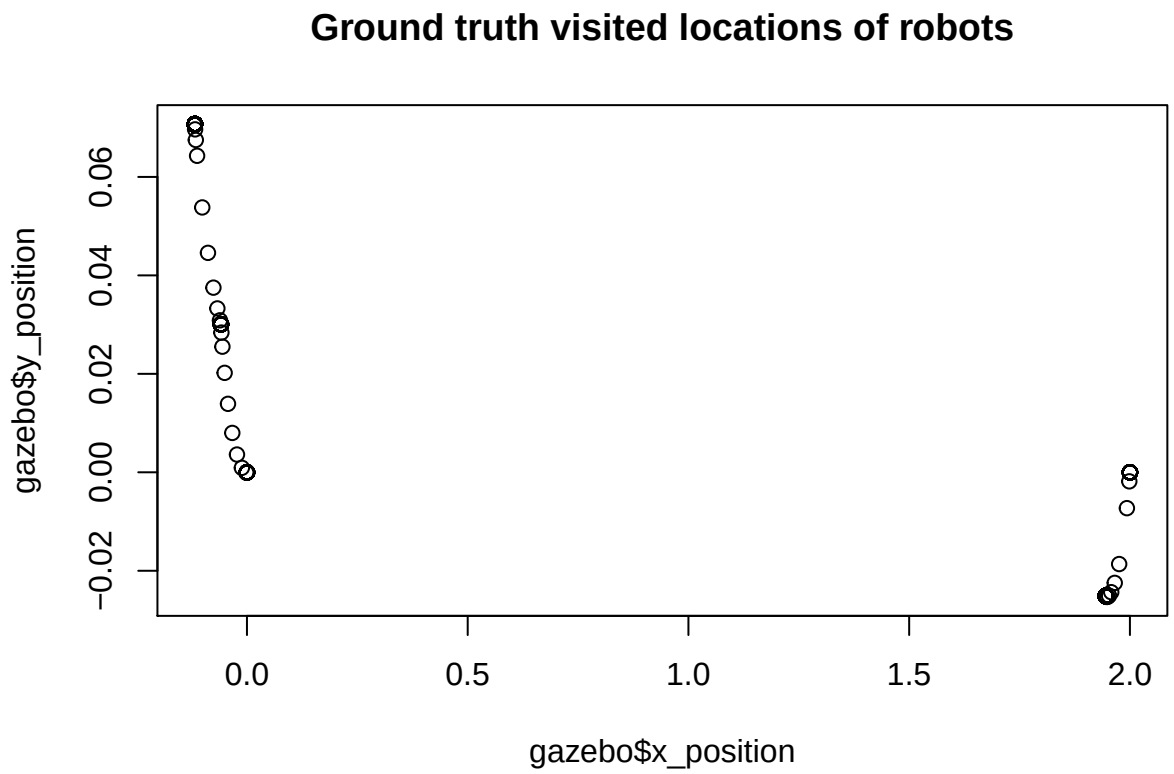
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     0.0   216.0   357.4   351.7   499.5   639.6
```

```
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.

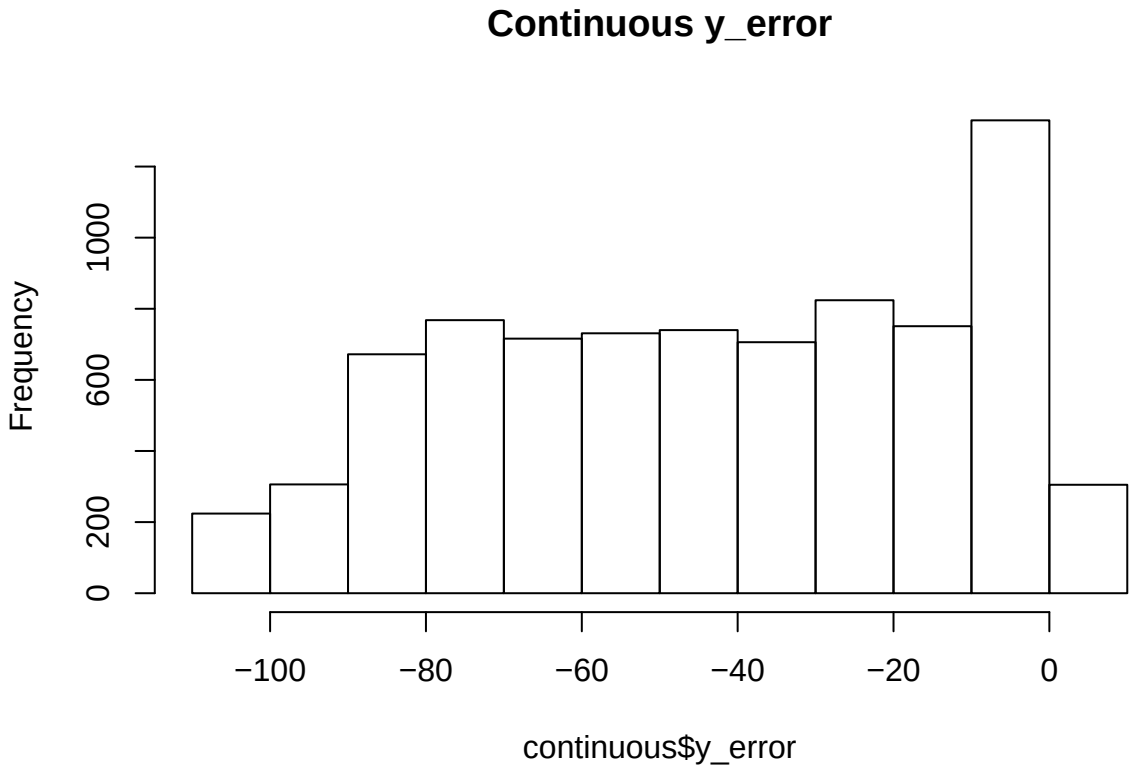
```r
plot(gazebo$x_position, gazebo$y_position,
     main = "Ground truth visited locations of robots")
```



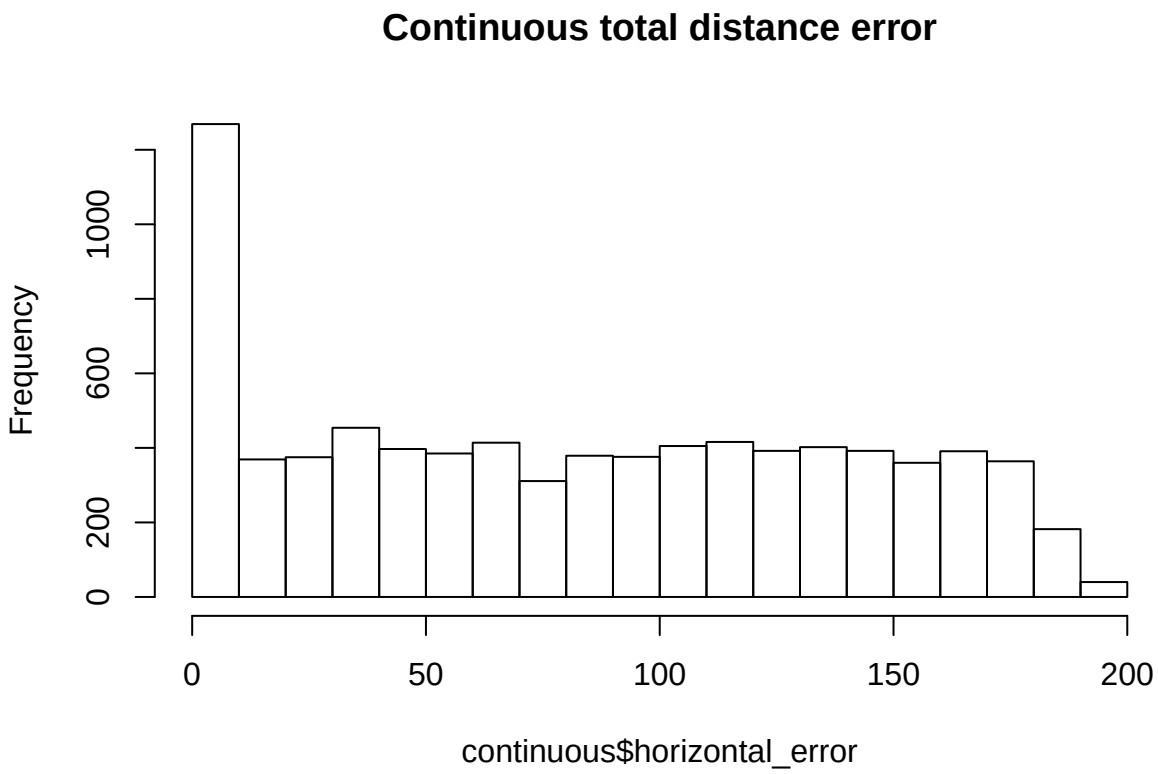

```r
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```

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

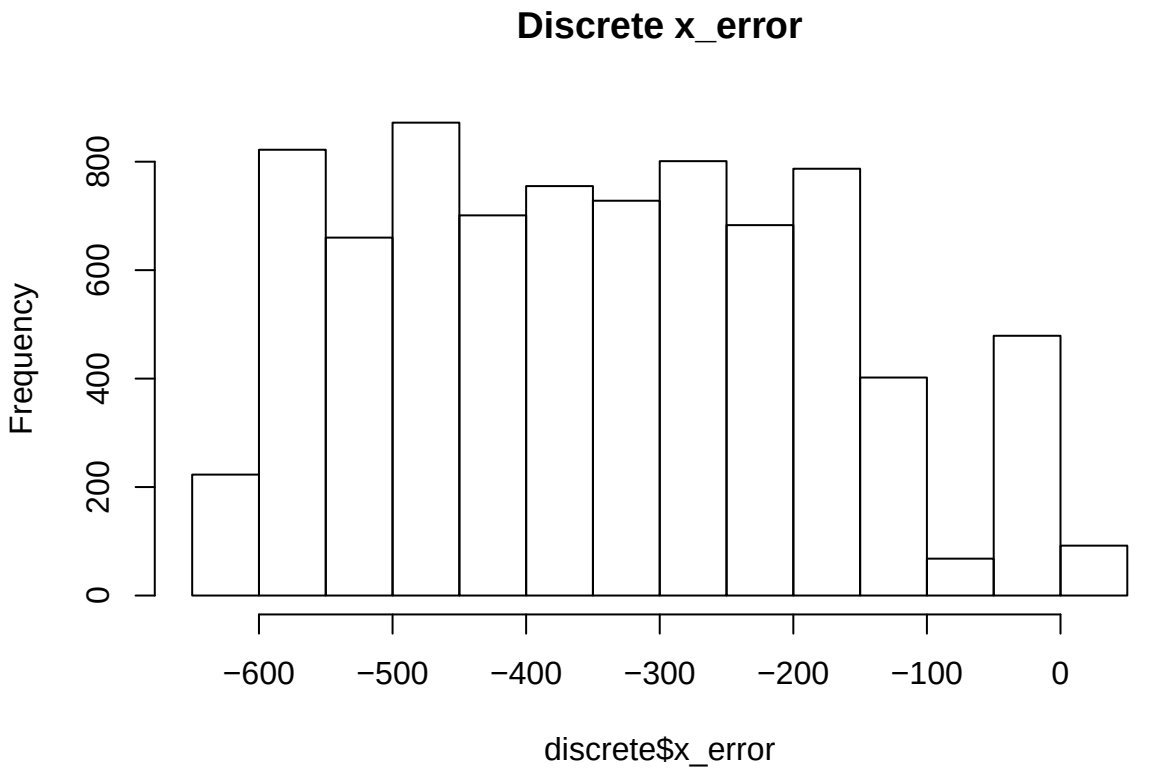

```r
hist(continuous$y_error,
      main = "Continuous y_error")
```



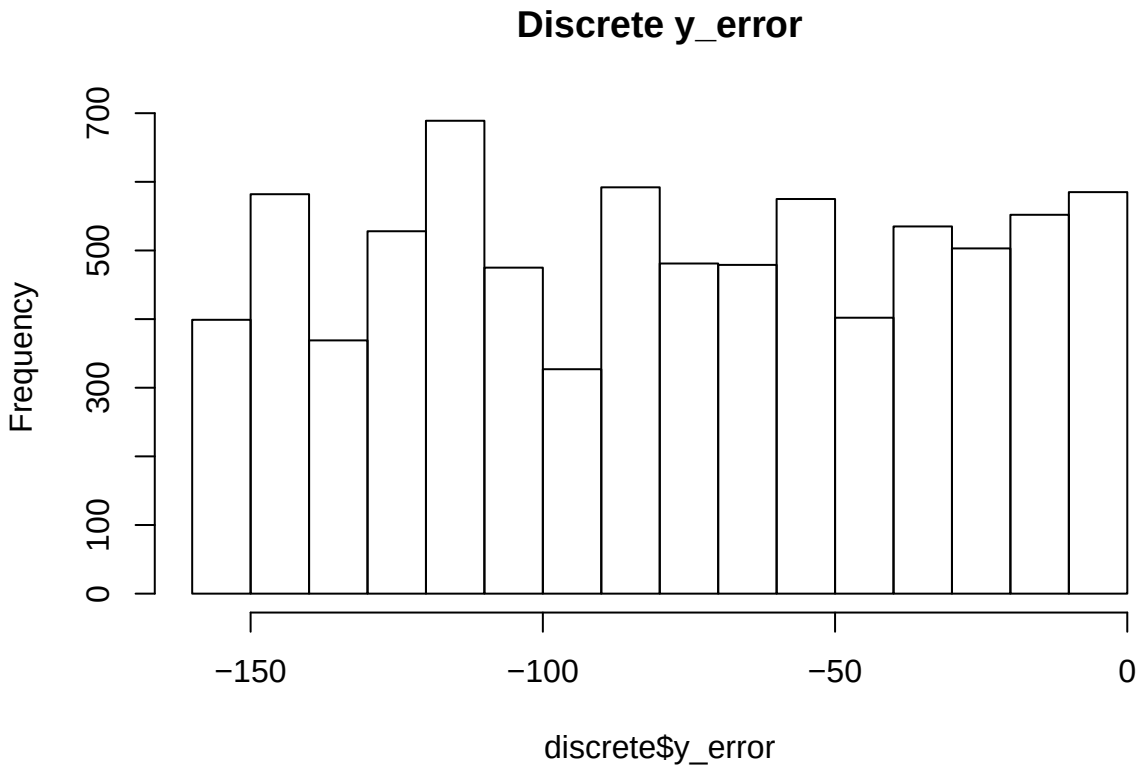
```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



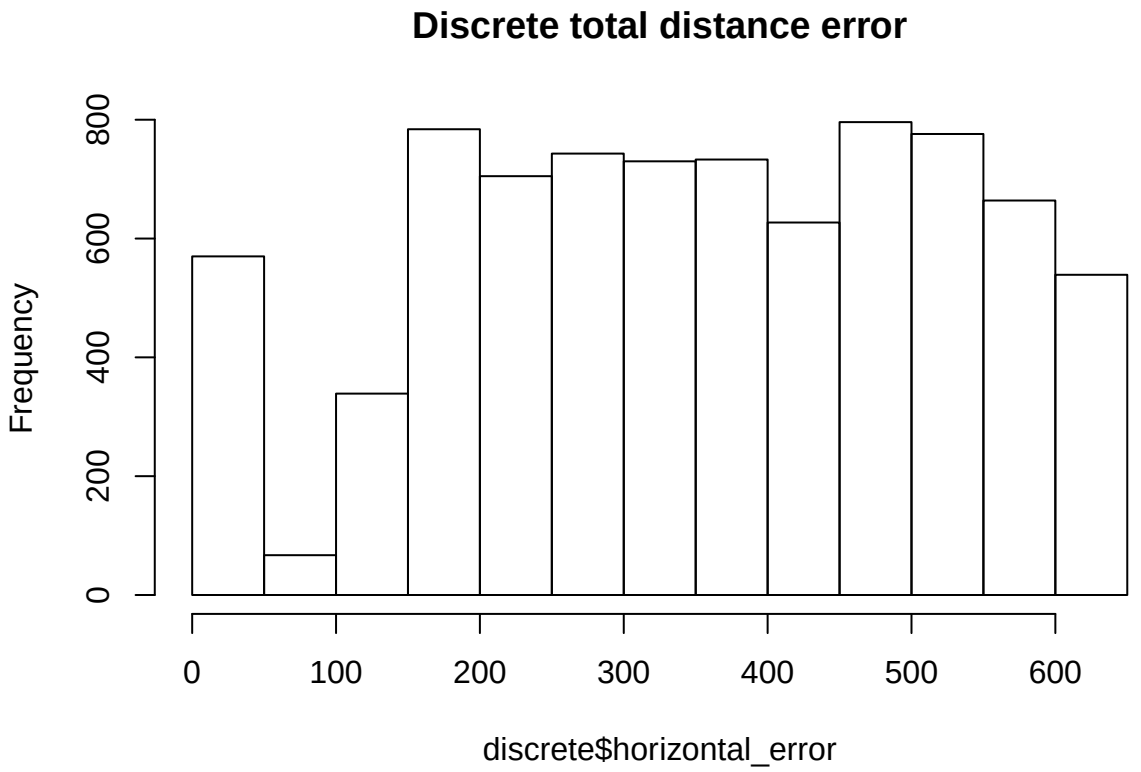

```r
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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 - 04:39:04 PM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for two-mobile-no-gps Experiment}
##   \label{tab:two_mobile_no_gps_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 & 8,073 & 71.002 & 49.890 & $-$0.000 & 173.786 \\
## y\_position & 8,073 & 43.031 & 30.904 & $-$0.00000004 & 107.759 \\
## yaw & 8,073 & 0.508 & 0.175 & $-$0.000 & 0.687 \\
## x\_variance & 8,073 & 104.684 & 73.357 & 0.056 & 256.823 \\
## y\_variance & 8,073 & 48.343 & 34.350 & 0.056 & 125.754 \\
## yaw\_variance & 8,073 & 109.756 & 75.936 & 0.067 & 247.826 \\
## yaw\_error & 8,073 & 0.010 & 1.803 & $-$3.141 & 3.141 \\
## x\_error & 8,073 & $-$70.091 & 49.716 & $-$171.841 & 0.00004 \\
```

```
## y\_error & 8,073 & $-$43.009 & 30.899 & $-$107.688 & 0.071 \\
## horizontal\_error & 8,073 & 82.513 & 58.142 & 0.00001 & 193.227 \\
## \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 - 04:39:04 PM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for two-mobile-no-gps Experiment}
##   \label{tab:two_mobile_no_gps_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 & 8,073 & 343.596 & 167.175 & $-$0.000 & 619.235 \\
## y\_position & 8,073 & 78.295 & 46.270 & $-$0.000 & 159.927 \\
## yaw & 8,073 & 0.522 & 0.178 & $-$0.000 & 0.701 \\
## x\_variance & 8,073 & 0.682 & 0.898 & 0.0002 & 9.226 \\
## y\_variance & 8,073 & 0.347 & 0.389 & 0.0002 & 3.295 \\
## yaw\_variance & 8,073 & 109.894 & 76.030 & 0.067 & 247.838 \\
## x\_error & 8,073 & $-$342.685 & 167.181 & $-$619.352 & 0.272 \\
## y\_error & 8,073 & $-$78.272 & 46.269 & $-$159.857 & 0.000 \\
## horizontal\_error & 8,073 & 351.698 & 173.083 & 0.00001 & 639.650 \\
## yaw\_error & 8,073 & 0.019 & 1.803 & $-$3.141 & 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)
}
```