two_stationary Experiment Report

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This is a summary of the data from the two_stationary 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.
## 1.421e-05 2.065e-03 4.116e-03 4.116e-03 6.164e-03 8.216e-03
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 8.990e-10 1.398e-06 5.367e-06 7.108e-06 1.197e-05 2.193e-05
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 8.536e-05 1.294e-03 2.643e-03 2.561e-03 3.787e-03 5.215e-03
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.421e-05 2.065e-03 4.116e-03 4.116e-03 6.164e-03 8.216e-03
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -1.84500 -0.43400 -0.01889 -0.04592  0.20880  1.34000
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -1.813000 -0.300400  0.003635  0.012860  0.332800  1.759000
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -7.803e-05  9.100e-06  2.711e-05  3.114e-05  4.916e-05  1.978e-04
```

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

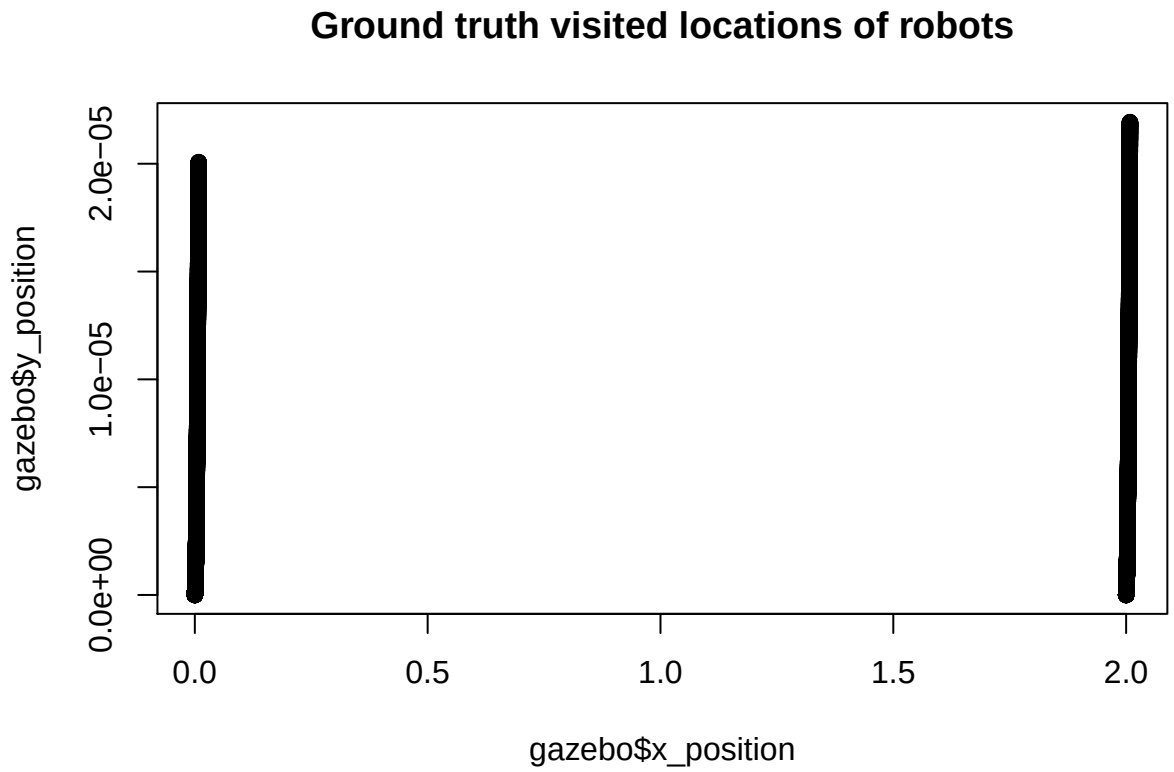
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.0000142 0.3289000 0.6121000 0.7191000 1.0760000 2.5830000
```

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

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

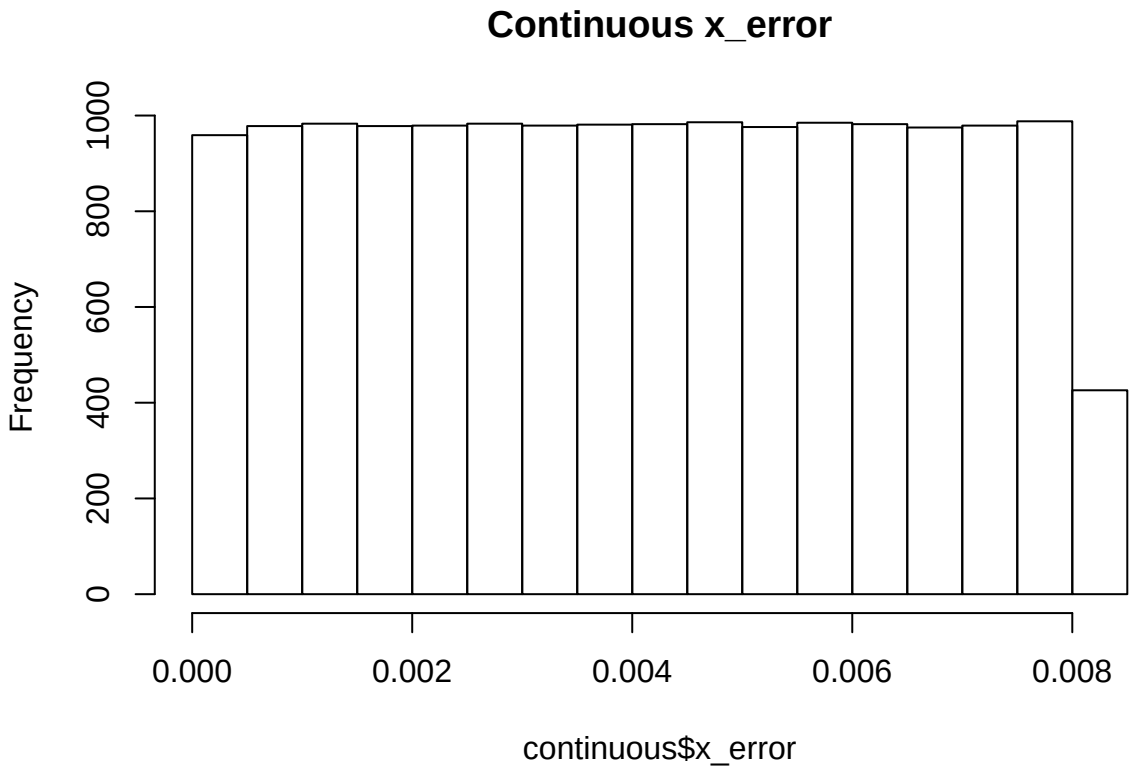
Shown below are plots representing the robot's motion and error over time.

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

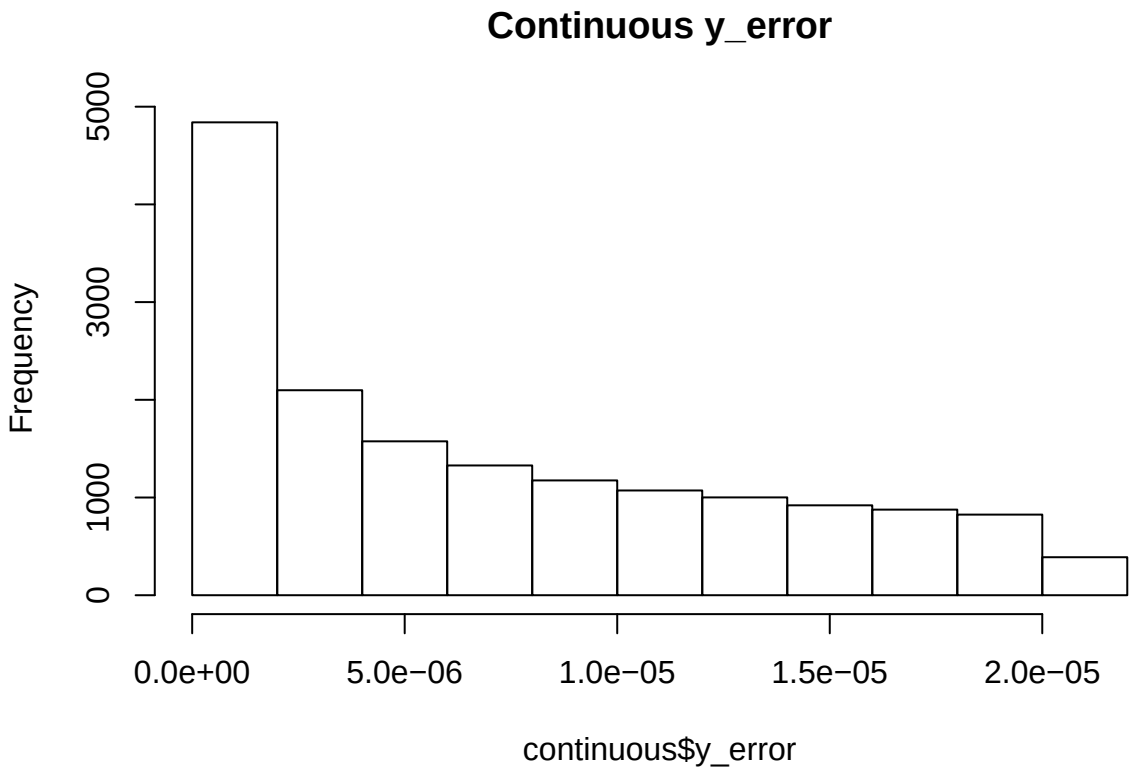



```r
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```

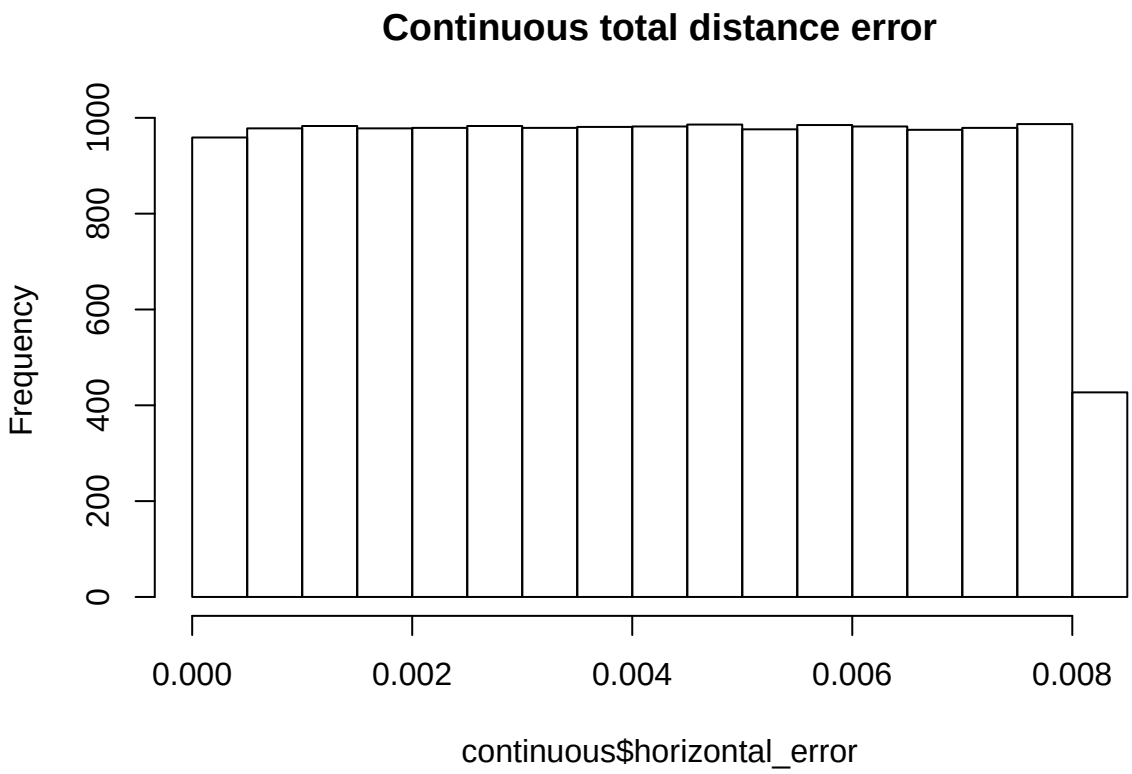
```r
hist(continuous$x_error,
     main = "Continuous x_error")
```



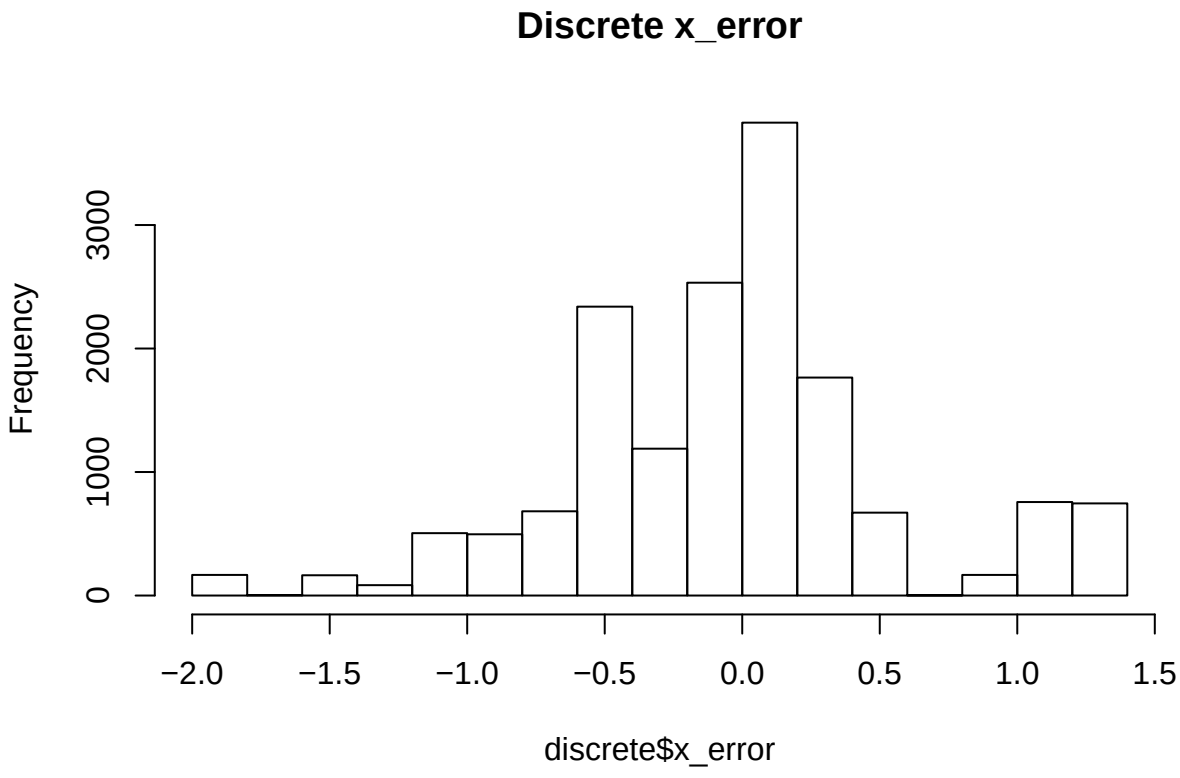

```r
hist(continuous$y_error,
      main = "Continuous y_error")
```



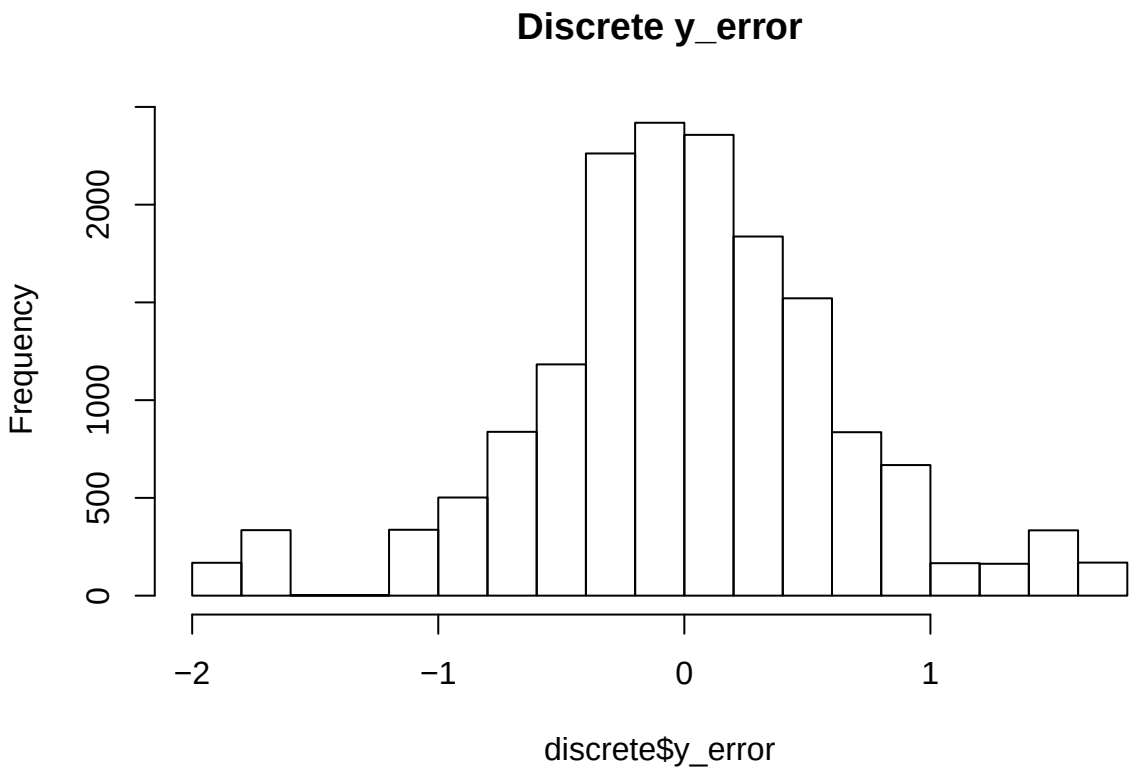
```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



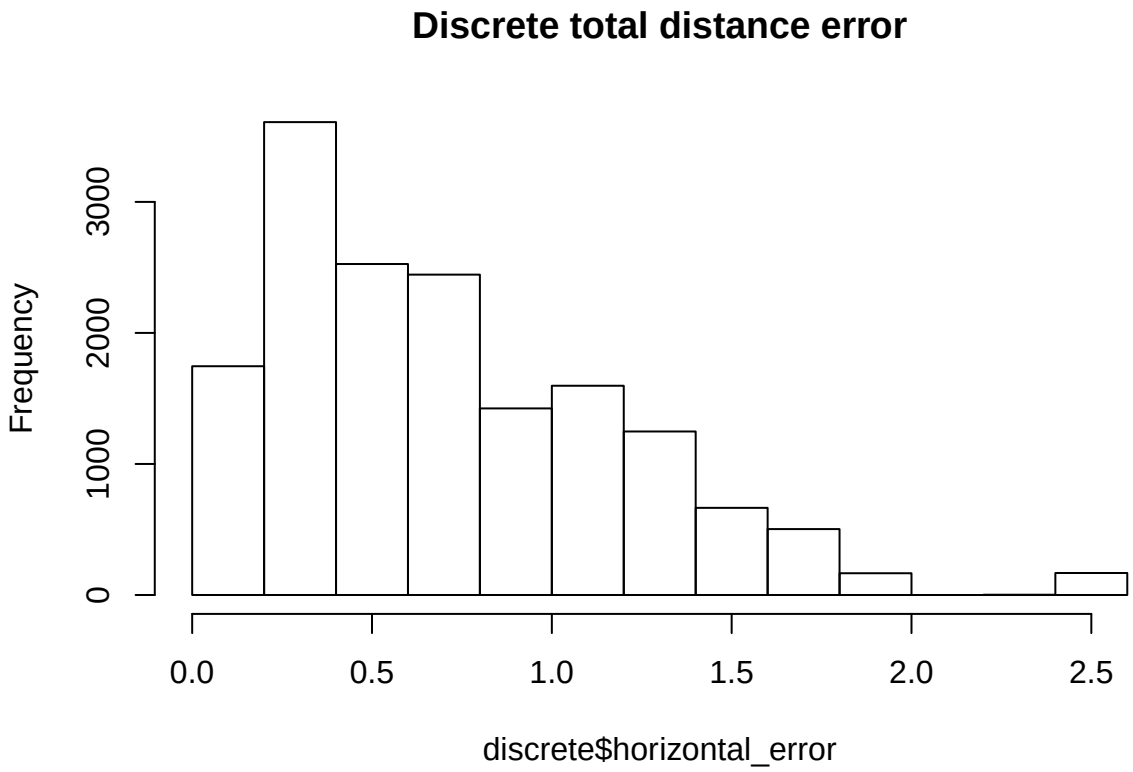

```r
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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 - 10:08:10 PM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for two-stationary Experiment}
##   \label{tab:two_stationary_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 & 16,099 & 0.999 & 1.000 & $-$0 & 2 \\
## y\_position & 16,099 & 0.000 & 0.000 & $-$0 & 0 \\
## yaw & 16,099 & 0.000 & 0.000 & $-$0 & 0 \\
## x\_variance & 16,099 & 24.076 & 13.863 & 0.073 & 48.068 \\
## y\_variance & 16,099 & 24.076 & 13.863 & 0.073 & 48.068 \\
## yaw\_variance & 16,099 & 28.859 & 16.617 & 0.088 & 57.620 \\
## yaw\_error & 16,099 & 0.003 & 0.001 & 0.0001 & 0.005 \\
## x\_error & 16,099 & 0.004 & 0.002 & 0.00001 & 0.008 \\
```

```
## y\_error & 16,099 & 0.00001 & 0.00001 & 0.000 & 0.00002 \\
## horizontal\_error & 16,099 & 0.004 & 0.002 & 0.00001 & 0.008 \\
## \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 - 10:08:11 PM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for two-stationary Experiment}
##   \label{tab:two_stationary_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 & 16,099 & 1.049 & 1.150 & $-$1.304 & 3.823 \\
## y\_position & 16,099 & $-$0.013 & 0.633 & $-$1.759 & 1.813 \\
## yaw & 16,099 & 0.003 & 0.001 & $-$0.000 & 0.005 \\
## x\_variance & 16,099 & 0.716 & 0.723 & 0.002 & 1.701 \\
## y\_variance & 16,099 & 0.716 & 0.723 & 0.002 & 1.701 \\
## yaw\_variance & 16,099 & 0.390 & 0.173 & 0.088 & 0.695 \\
## x\_error & 16,099 & $-$0.046 & 0.593 & $-$1.845 & 1.340 \\
## y\_error & 16,099 & 0.013 & 0.633 & $-$1.813 & 1.759 \\
## horizontal\_error & 16,099 & 0.719 & 0.487 & 0.00001 & 2.583 \\
## yaw\_error & 16,099 & 0.00003 & 0.00003 & $-$0.0001 & 0.0002 \\
## \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)
}
```