two_stationary_noiseless Experiment Report

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This is a summary of the data from the two_stationary_noiseless 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.
## 1.477e-05 1.385e-04 2.621e-04 2.629e-04 3.876e-04 5.129e-04
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 8.426e-10 1.641e-08 4.103e-08 5.061e-08 8.074e-08 1.421e-07
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 5.879e-05 1.585e-04 2.590e-04 2.594e-04 3.510e-04 4.535e-04
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.477e-05 1.385e-04 2.621e-04 2.629e-04 3.876e-04 5.129e-04
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 7.693e-06 4.798e-05 9.075e-05 1.502e-02 3.020e-02 3.024e-02
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.440e-03 -3.041e-03  1.000e-09 -1.508e-03  7.000e-09  3.800e-08
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.779e-05  9.020e-06  3.486e-05  4.252e-05  6.569e-05  1.979e-04
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 7.693e-06 4.798e-05 9.075e-05 1.510e-02 3.035e-02 3.043e-02
```

```
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")
```
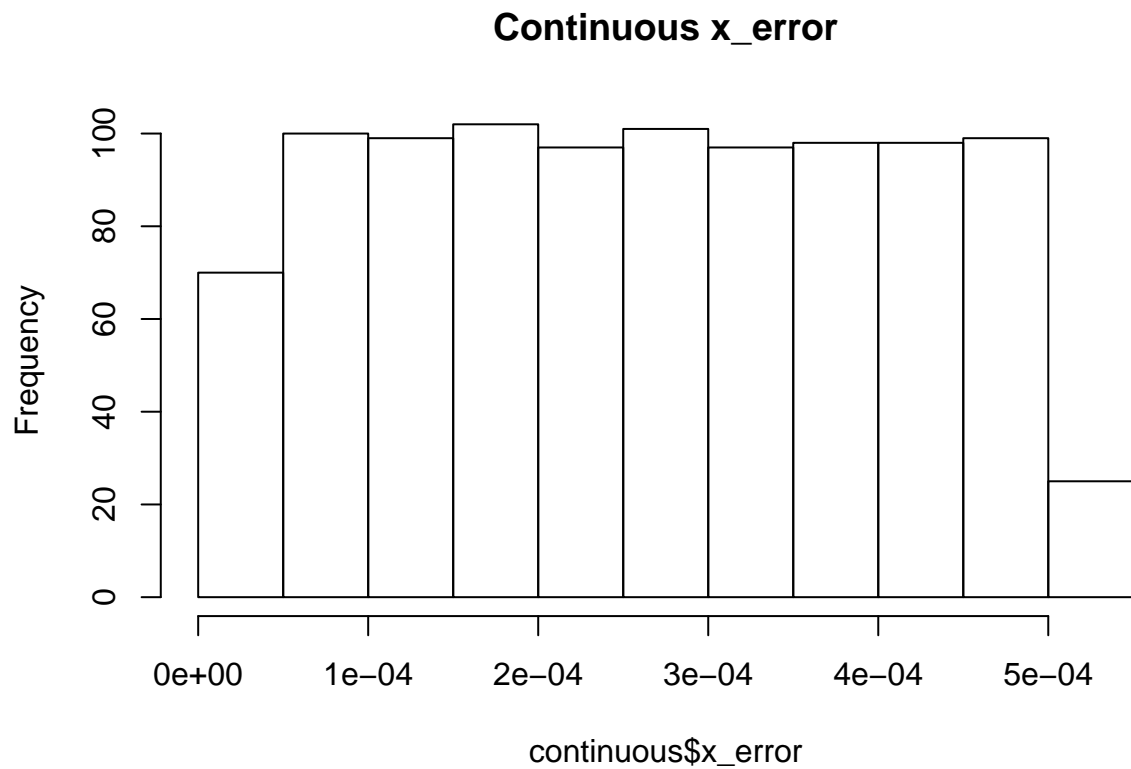
Ground truth visited locations of robots


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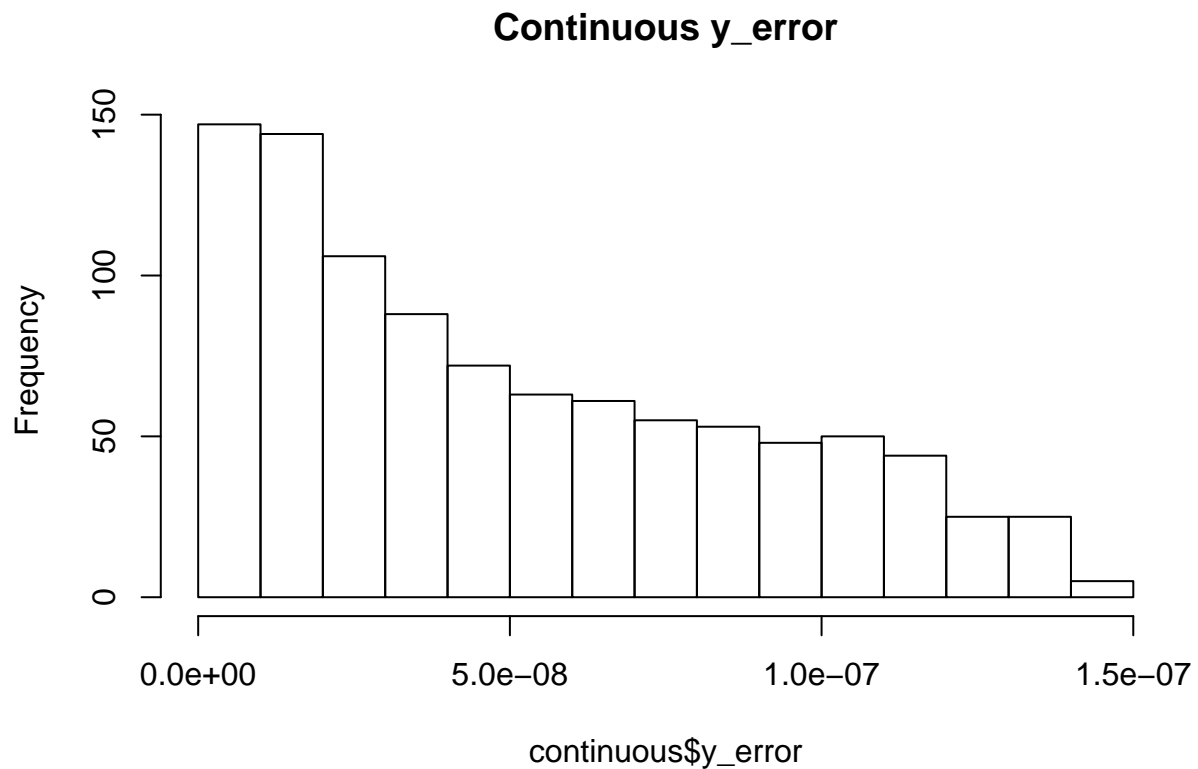
Distance from origin vs. time
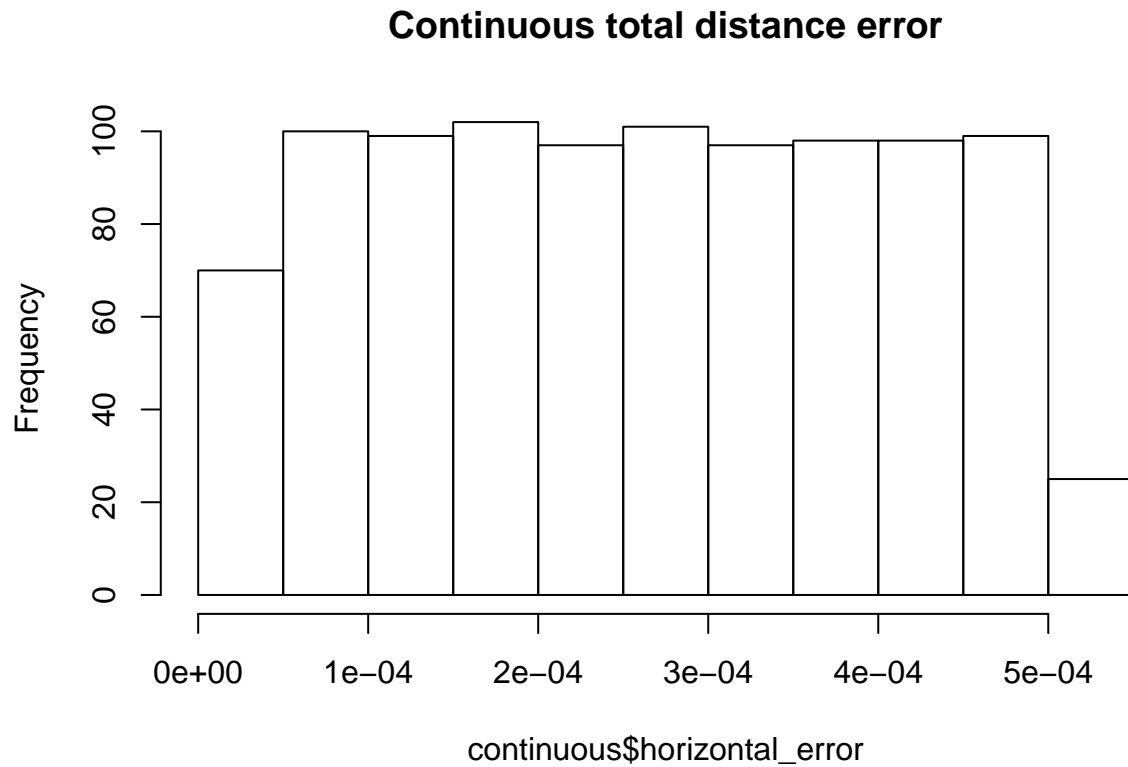
```
hist(continuous$x_error,
     main = "Continuous x_error")
```
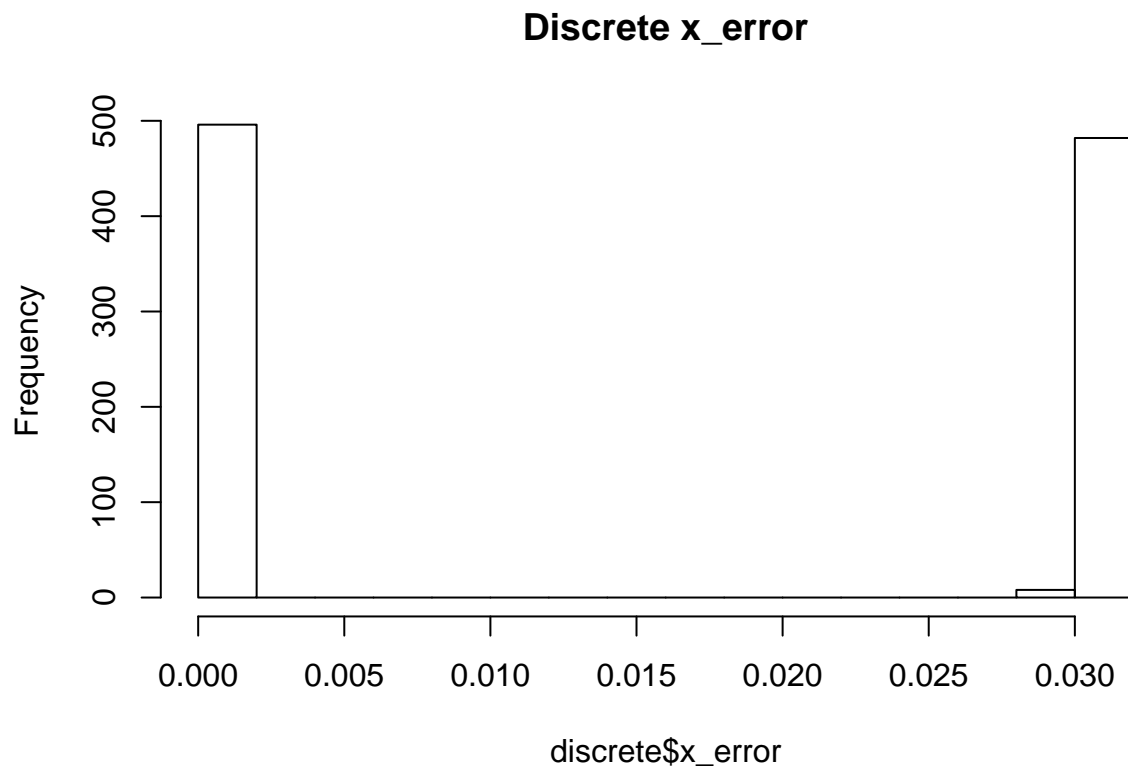
Continuous x_error


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

Continuous y_error

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

Continuous total distance error

continuous$horizontal_error

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

Discrete x_error

discrete$x_error

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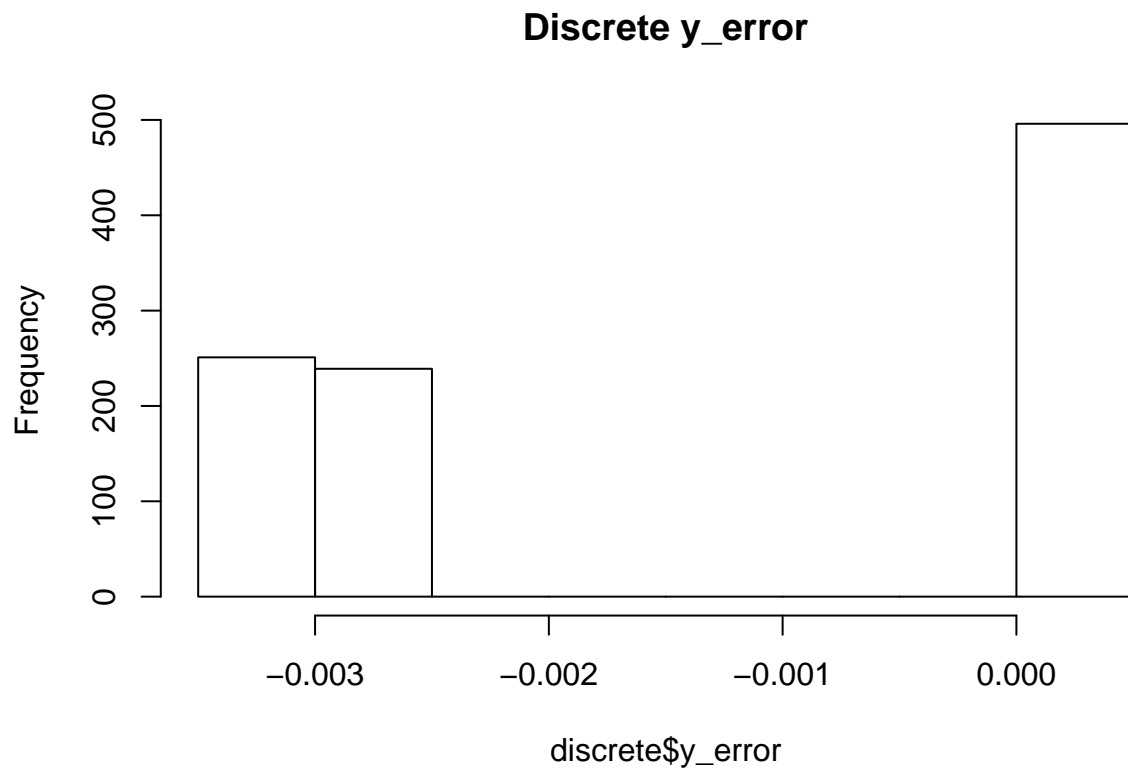
Discrete y_error


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

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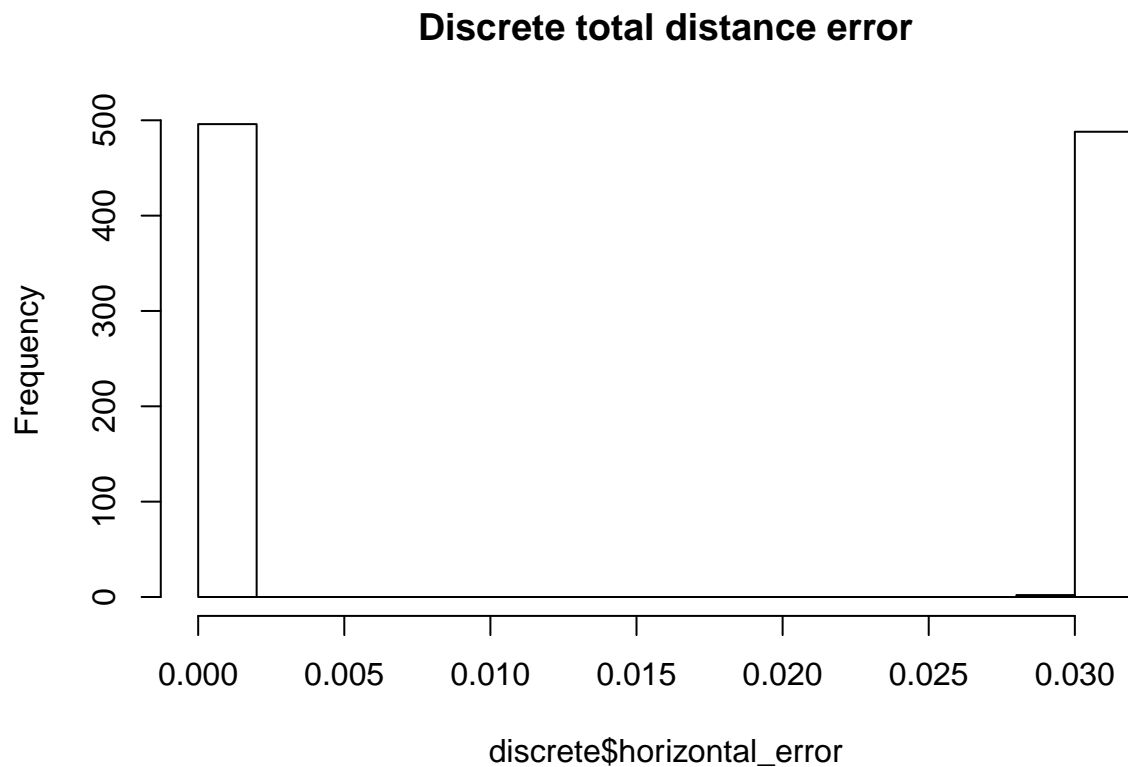
```r
figure_dir <- "/home/matt/thesis/writing/r_figures/"
filename = paste0(figure_dir, params$experiment, "_continuous_error.pdf")
pdf(filename)
plot(continuous$horizontal_error, main="Continuous Filter Error", sub=paste0("For ", params$experiment,

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 - 04:04:40 PM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for two-stationary-noiseless Experiment}
##   \label{tab:two_stationary_noiseless_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 & 986 & 0.994 & 1.000 & $-$0 & 2 \\
## y\_position & 986 & 0.000 & 0.000 & $-$0 & 0 \\
## yaw & 986 & $-$0.000 & 0.000 & $-$0 & 0 \\
## x\_variance & 986 & 2.832 & 1.561 & 0.134 & 5.541 \\
## y\_variance & 986 & 2.832 & 1.561 & 0.134 & 5.541 \\
## yaw\_variance & 986 & 2.553 & 1.410 & 0.121 & 5.000 \\
## yaw\_error & 986 & 0.0003 & 0.0001 & 0.0001 & 0.0005 \\
## x\_error & 986 & 0.0003 & 0.0001 & 0.00001 & 0.001 \\
```

```
## y\_error & 986 & 0.0000001 & 0.00000004 & 0.000 & 0.0000001 \\
## horizontal\_error & 986 & 0.0003 & 0.0001 & 0.00001 & 0.001 \\
## \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 - 04:04:40 PM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for two-stationary-noiseless Experiment}
##   \label{tab:two_stationary_noiseless_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.} & \multic
## \hline \\[-1.8ex]
## x\_position & 986 & 0.979 & 0.985 & $-$0.000 & 1.972 \\
## y\_position & 986 & 0.002 & 0.002 & $-$0.000 & 0.003 \\
## yaw & 986 & 0.0002 & 0.0001 & $-$0.000 & 0.0004 \\
## x\_variance & 986 & 0.307 & 0.352 & 0.002 & 1.083 \\
## y\_variance & 986 & 0.307 & 0.352 & 0.002 & 1.083 \\
## yaw\_variance & 986 & 0.490 & 0.237 & 0.092 & 0.918 \\
## x\_error & 986 & 0.015 & 0.015 & 0.00001 & 0.030 \\
## y\_error & 986 & $-$0.002 & 0.002 & $-$0.003 & 0.00000004 \\
## horizontal\_error & 986 & 0.015 & 0.015 & 0.00001 & 0.030 \\
## yaw\_error & 986 & 0.00004 & 0.00005 & $-$0.00004 & 0.0002 \\
## \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)
}
```

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