one_stationary_noiseless Experiment Report

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This is a summary of the data from the one_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.
## -1.761e-07 -2.481e-09  1.910e-09  1.995e-07  9.844e-08  2.186e-06
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -1.531e-10 -8.890e-12  7.027e-12  1.049e-09  1.795e-10  1.136e-08
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.055e-05 -2.860e-06  1.977e-07  1.363e-07  3.145e-06  3.624e-05
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 2.800e-12 2.205e-09 5.193e-09 2.032e-07 1.020e-07 2.186e-06
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -3.20000 -0.53450 -0.01748 -0.02757  0.63170  3.45800
```

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

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -4.43400 -0.33000  0.06292  0.18060  0.78430  4.14200
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -9.684e-04 -9.145e-05  1.291e-05  1.118e-05  1.246e-04  7.550e-04
```

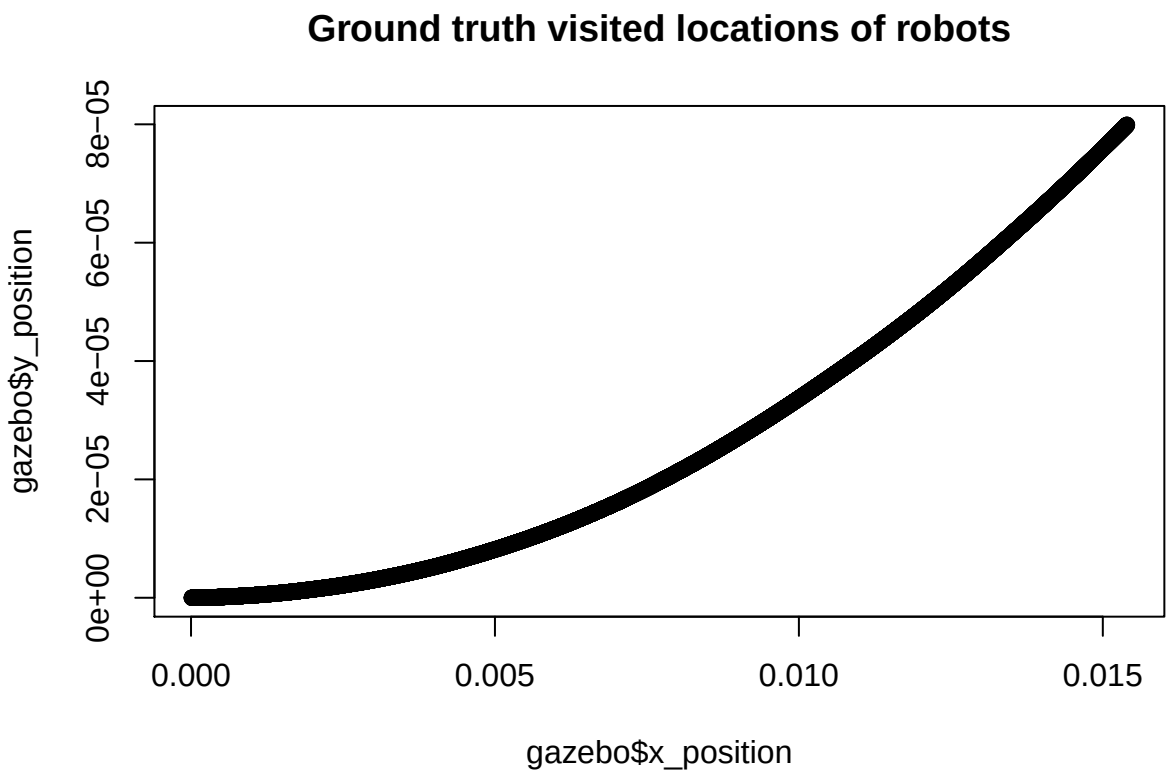
```r
summary(discrete$horizontal_error)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.0000  0.3949  1.0320  1.3160  2.0380  4.4980
```

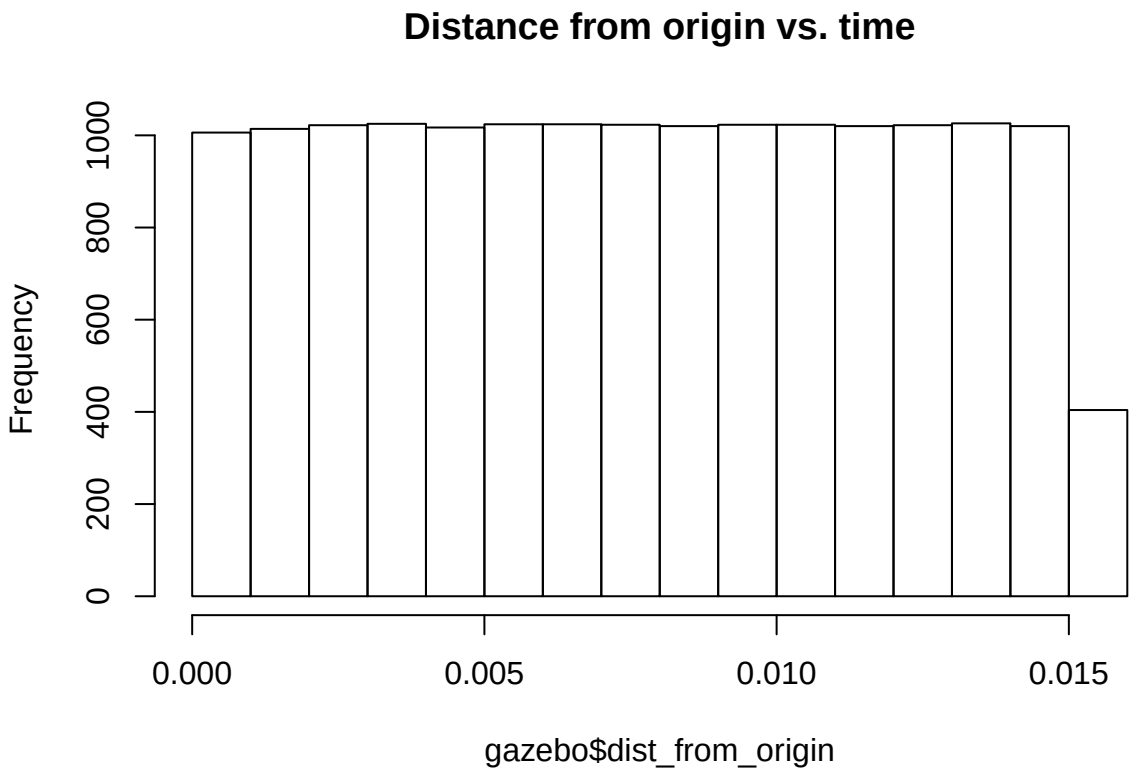
```r
if (params$robot >= 2) {
    summary(external_data_averages)
}
```

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

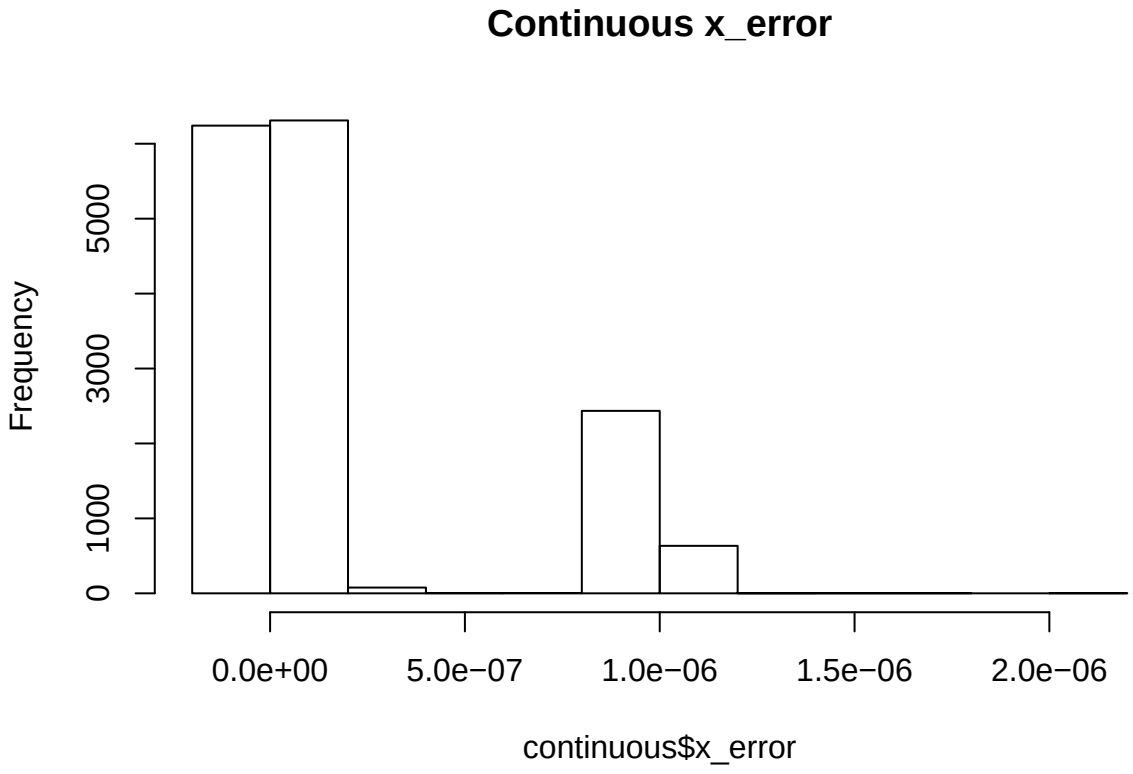
```r
plot(gazebo$x_position, gazebo$y_position,
     main = "Ground truth visited locations of robots")
```



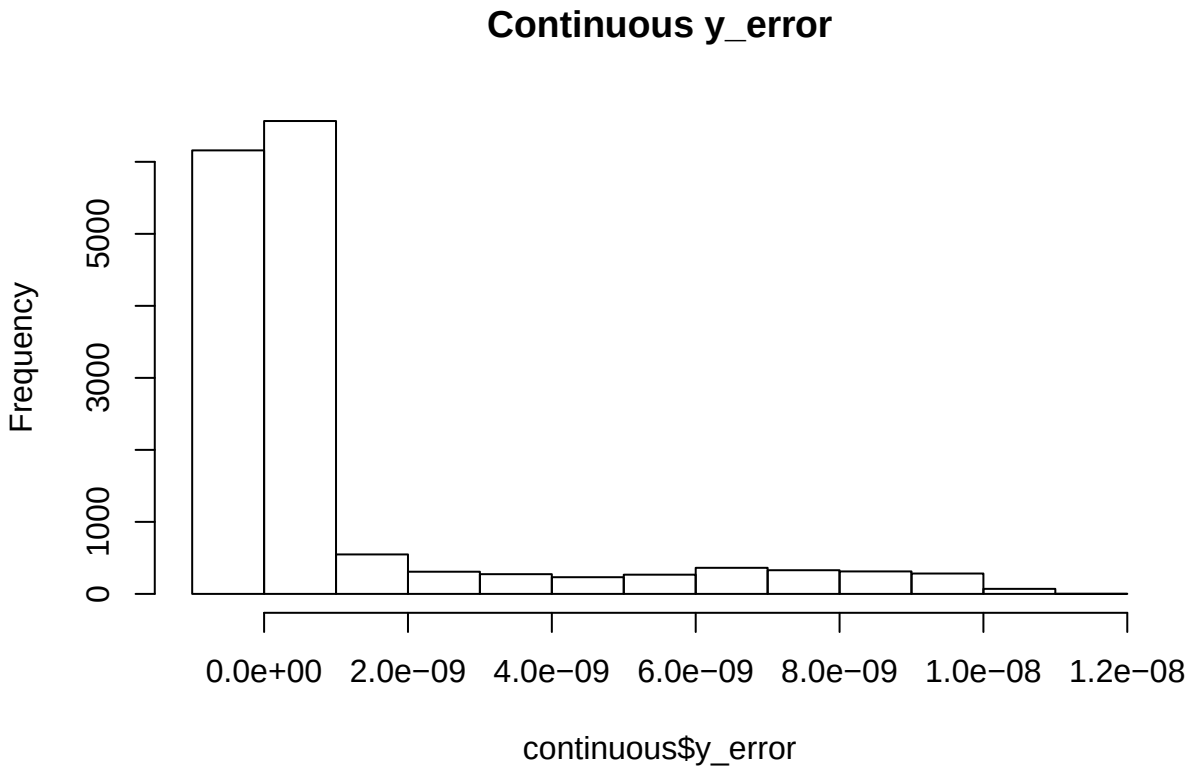

```r
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```



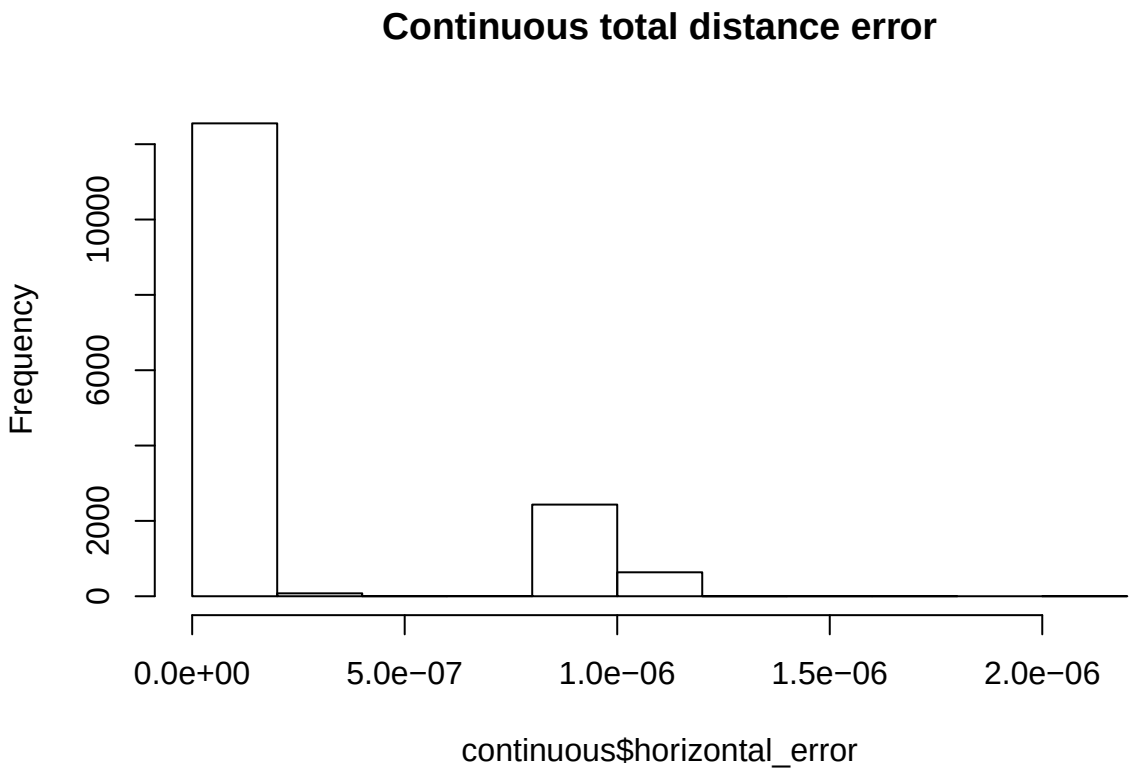

```
hist(continuous$x_error,
     main = "Continuous x_error")
```



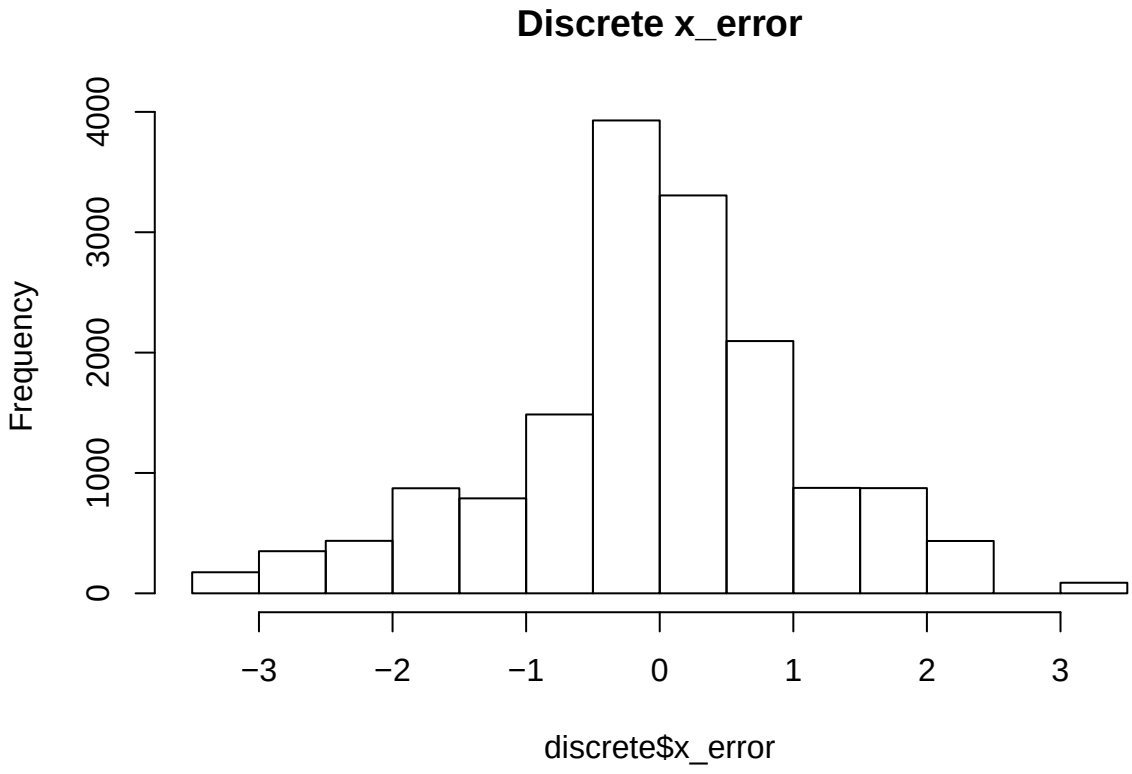
```r
hist(continuous$y_error,
     main = "Continuous y_error")
```



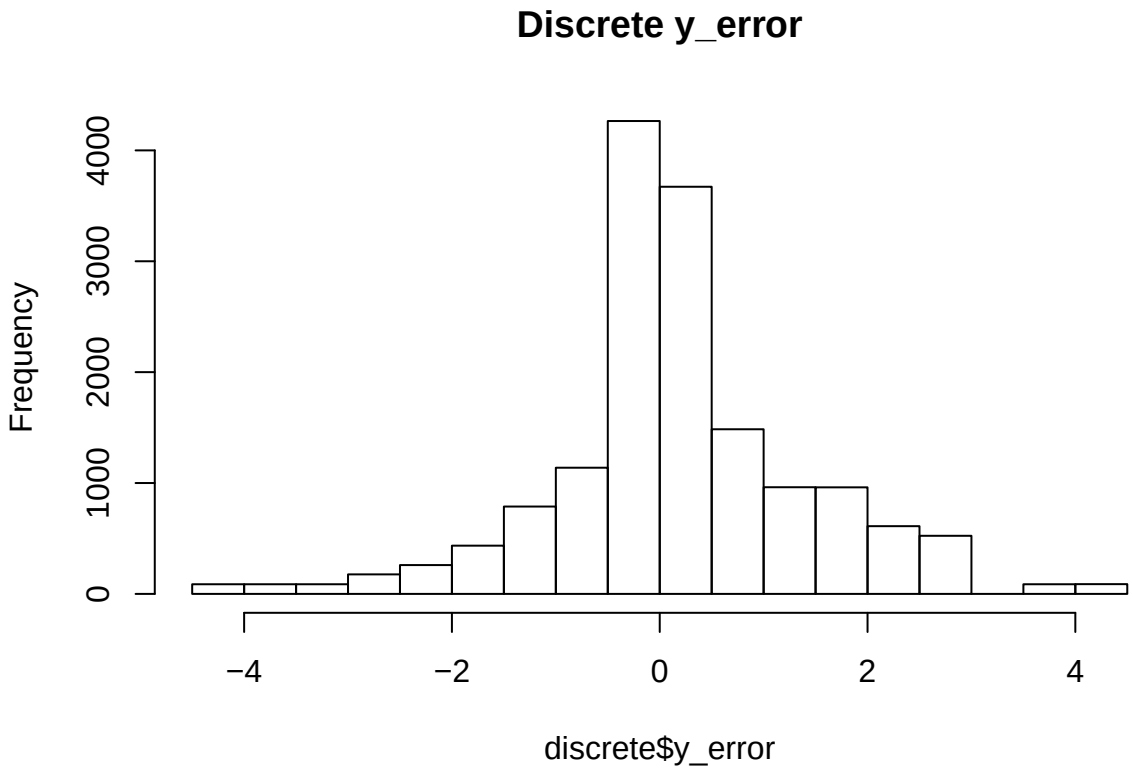

```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



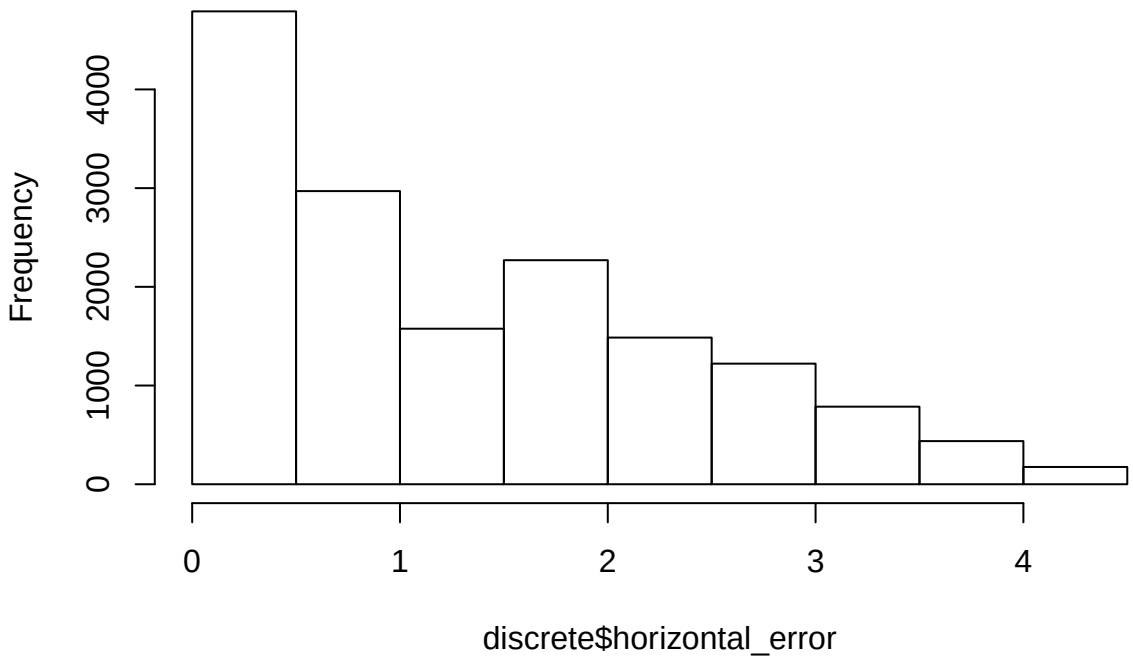

```
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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()
}
```

```
## pdf
##   2
```

```
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: Tue, Aug 09, 2016 - 09:46:34 AM
## \begin{table}[h] \centering
##   \caption{Continuous Filter Estimate for one-stationary-noiseless Experiment}
##   \label{tab:one_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.} & \multi
## \hline \\[-1.8ex]
## x\_position & 15,713 & 0.008 & 0.004 & 0.00001 & 0.015 \\
## y\_position & 15,713 & 0.00003 & 0.00002 & 0.000 & 0.0001 \\
## yaw & 15,713 & 0.005 & 0.003 & 0.0001 & 0.010 \\
## yaw\_error & 15,713 & 0.0000001 & 0.00001 & $-$0.00003 & 0.00004 \\
## x\_error & 15,713 & 0.0000002 & 0.0000004 & $-$0.0000002 & 0.000002 \\
## y\_error & 15,713 & 0.000 & 0.000 & $-$0 & 0 \\
## horizontal\_error & 15,713 & 0.0000002 & 0.0000004 & 0.000 & 0.000002 \\
## \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: Tue, Aug 09, 2016 - 09:46:34 AM
## \begin{table}[h] \centering
##   \caption{Discrete Filter Estimate for one-stationary-noiseless Experiment}
##   \label{tab:one_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.} & \multi
```

```
## \hline \\[-1.8ex]
## x\_position & 15,713 & 0.035 & 1.112 & $-$3.449 & 3.201 \\
## y\_position & 15,713 & $-$0.181 & 1.257 & $-$4.142 & 4.434 \\
## yaw & 15,713 & 0.005 & 0.003 & $-$0.0002 & 0.011 \\
## x\_error & 15,713 & $-$0.028 & 1.112 & $-$3.200 & 3.458 \\
## y\_error & 15,713 & 0.181 & 1.257 & $-$4.434 & 4.142 \\
## horizontal\_error & 15,713 & 1.316 & 1.057 & 0.0000004 & 4.498 \\
## yaw\_error & 15,713 & 0.00001 & 0.0002 & $-$0.001 & 0.001 \\
## \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)
}
```

```
##
## % Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvar
## % Date and time: Tue, Aug 09, 2016 - 09:46:35 AM
## \begin{table}[h] \centering
##   \caption{Ground Truth Noiseless Odometry for Stationary Robot located at Origin}
##   \label{tab:gazebo_stationary_noiseless_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 & 15,713 & 0.008 & 0.004 & 0.00001 & 0.015 \\
## y\_position & 15,713 & 0.00003 & 0.00002 & 0.000 & 0.0001 \\
## yaw & 15,713 & 0.005 & 0.003 & 0.0001 & 0.010 \\
## dist\_from\_origin & 15,713 & 0.008 & 0.004 & 0.00001 & 0.015 \\
## horizontal\_error & 15,713 & 0.008 & 0.004 & 0.00001 & 0.015 \\
## \hline \\[-1.8ex]
## \end{tabular}
## \end{table}
```