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.
## 1.388e-05 1.398e-04 2.635e-04 2.638e-04 3.888e-04 5.133e-04
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.983e-08 -3.107e-08 -2.164e-09  4.478e-09  2.967e-08  9.691e-08
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -1.796e-04 -7.499e-05  4.814e-05  5.911e-05  1.554e-04  3.855e-04
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.388e-05 1.398e-04 2.635e-04 2.638e-04 3.888e-04 5.133e-04
```

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

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.291e-05 5.388e-05 9.863e-05 1.508e-02 3.020e-02 3.024e-02
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -2.696e-03 -2.513e-03 -1.280e-08 -1.263e-03 -3.700e-09  0.000e+00
```

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

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -1.404e-04 -6.358e-06  1.659e-05  1.262e-05  3.901e-05  1.194e-04
```

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

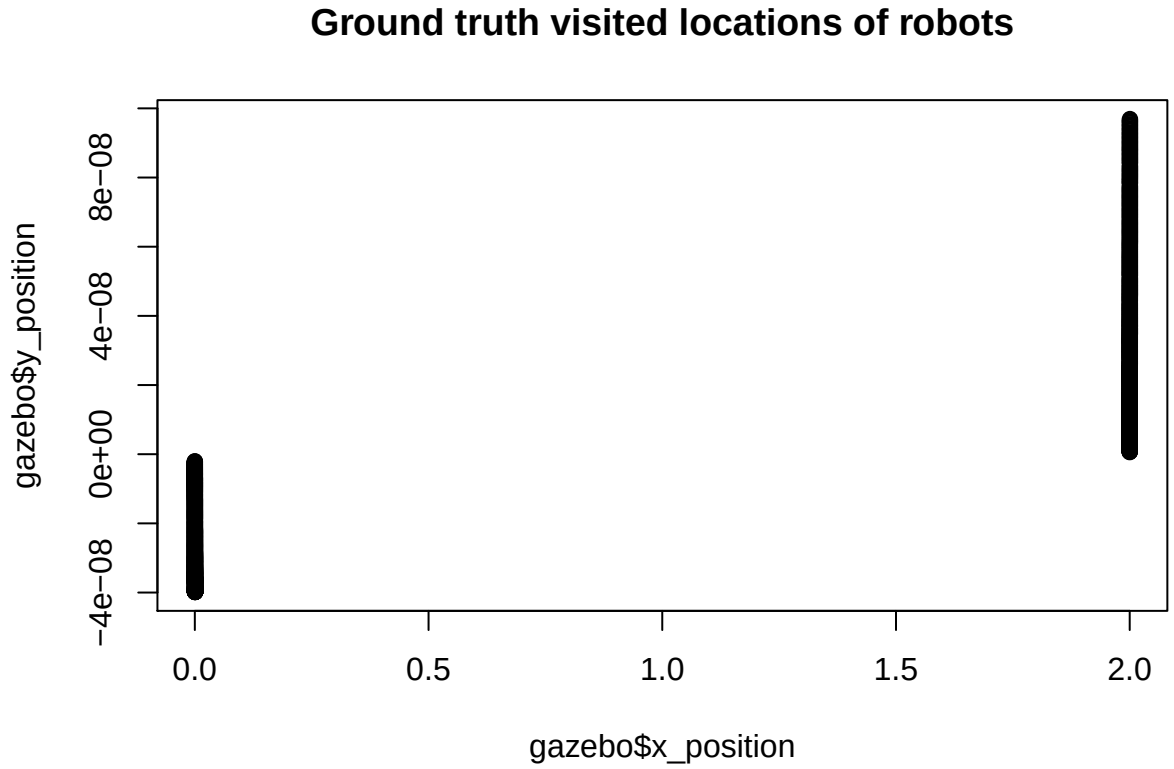
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.291e-05 5.388e-05 9.863e-05 1.513e-02 3.030e-02 3.035e-02
```

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

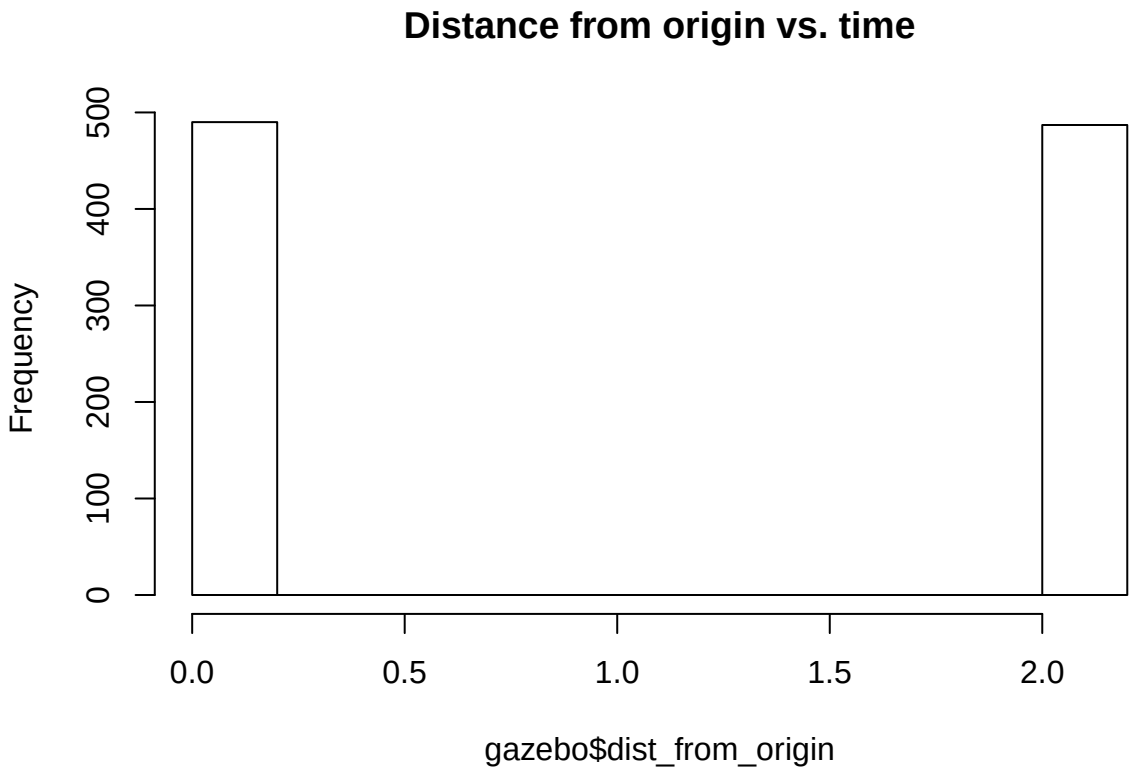
```
##      Length Class  Mode
## [1,] 1      -none- numeric
## [2,] 1      -none- numeric
```

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

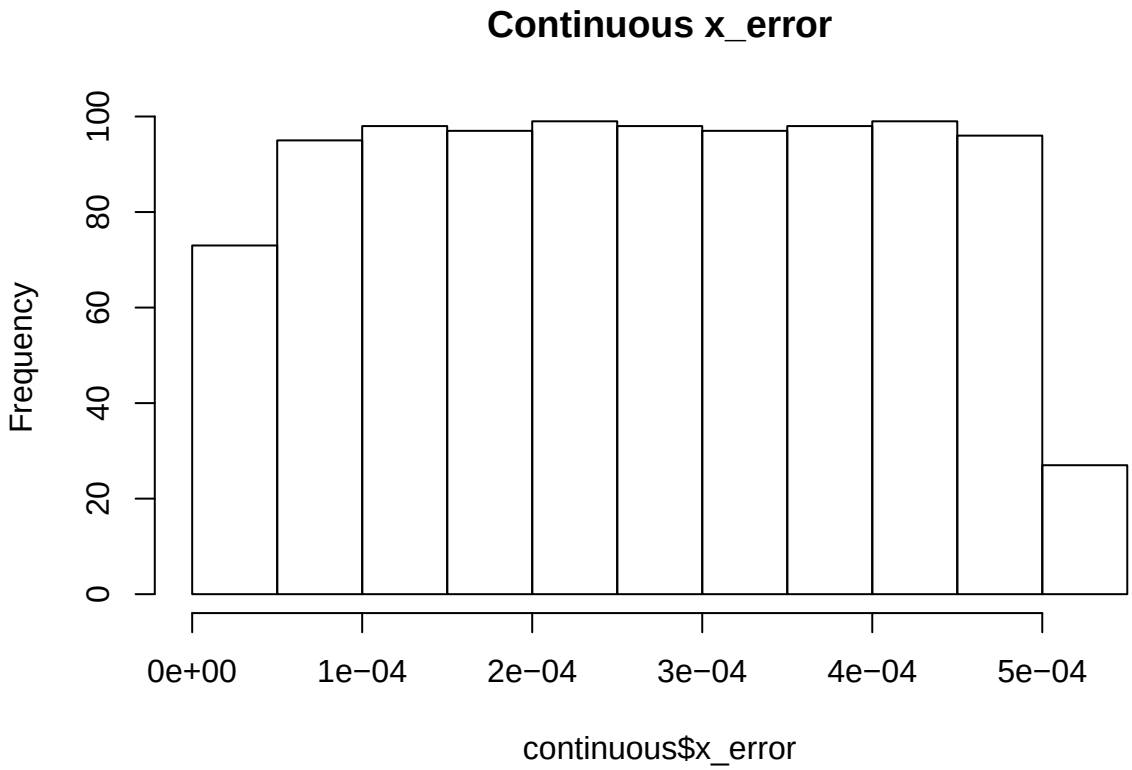
```r
plot(gazebo$x_position, gazebo$y_position,
     main = "Ground truth visited locations of robots")
```



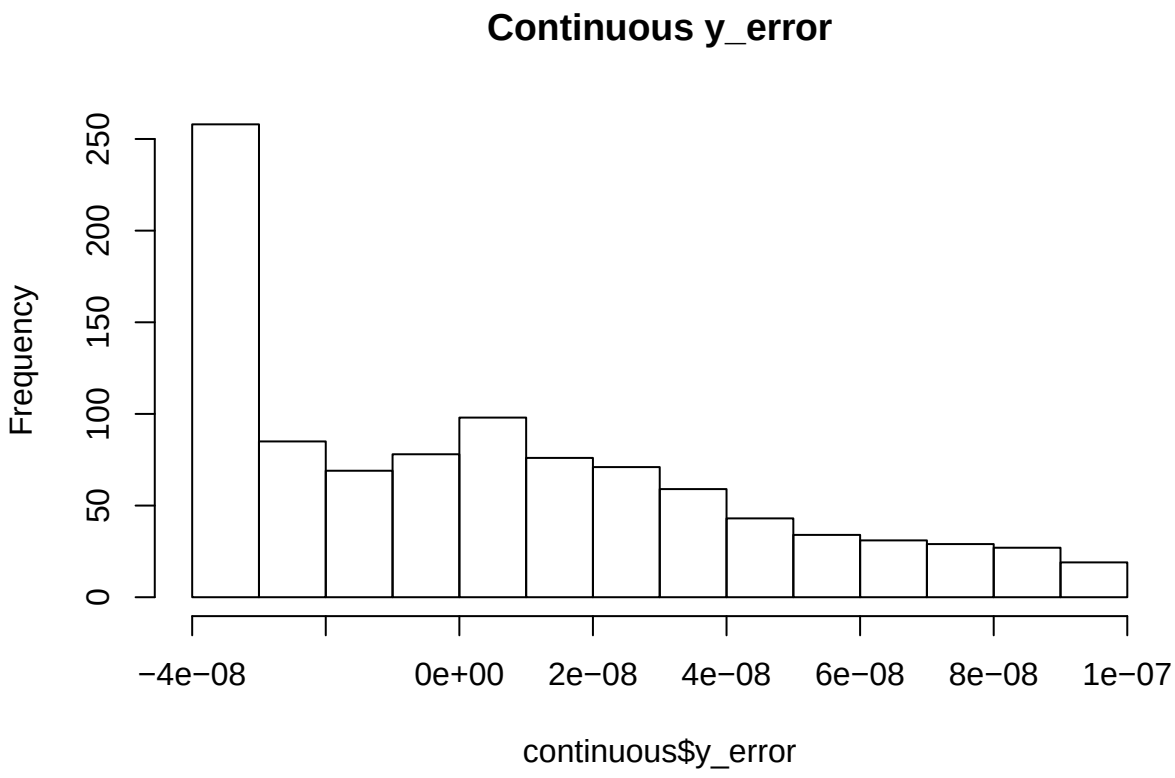

```r
hist(gazebo$dist_from_origin,
     main = "Distance from origin vs. time")
```



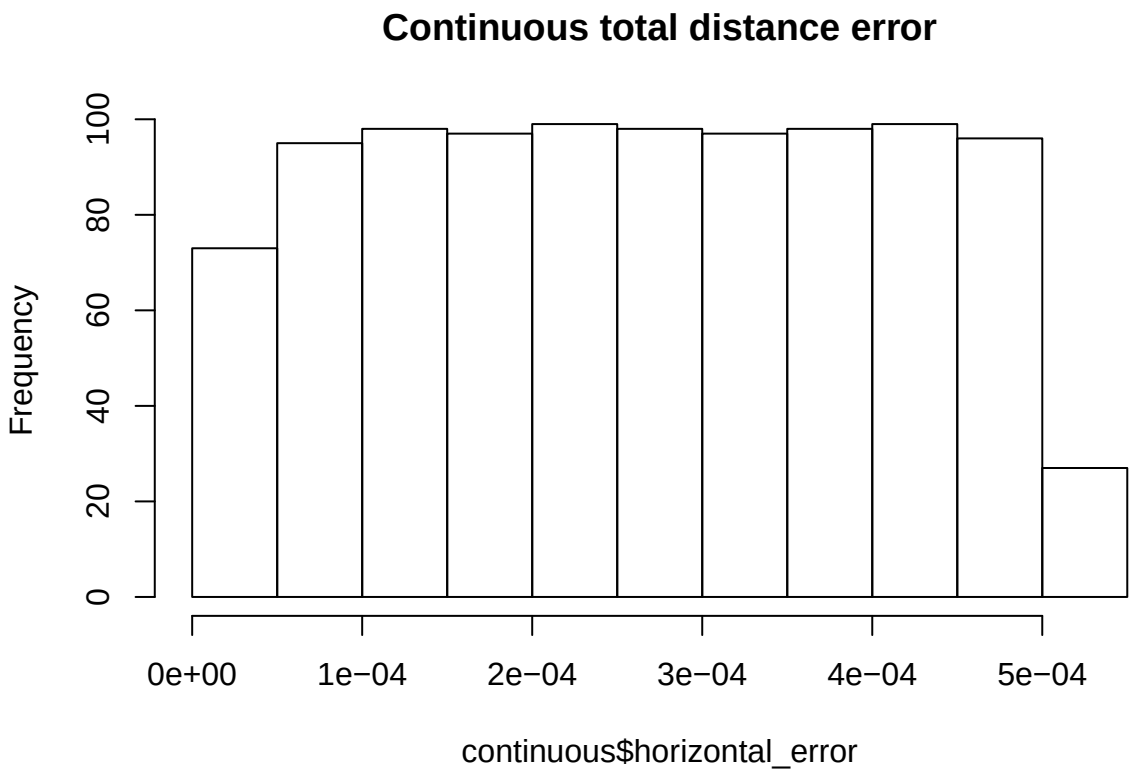
```r
hist(continuous$x_error,
     main = "Continuous x_error")
```



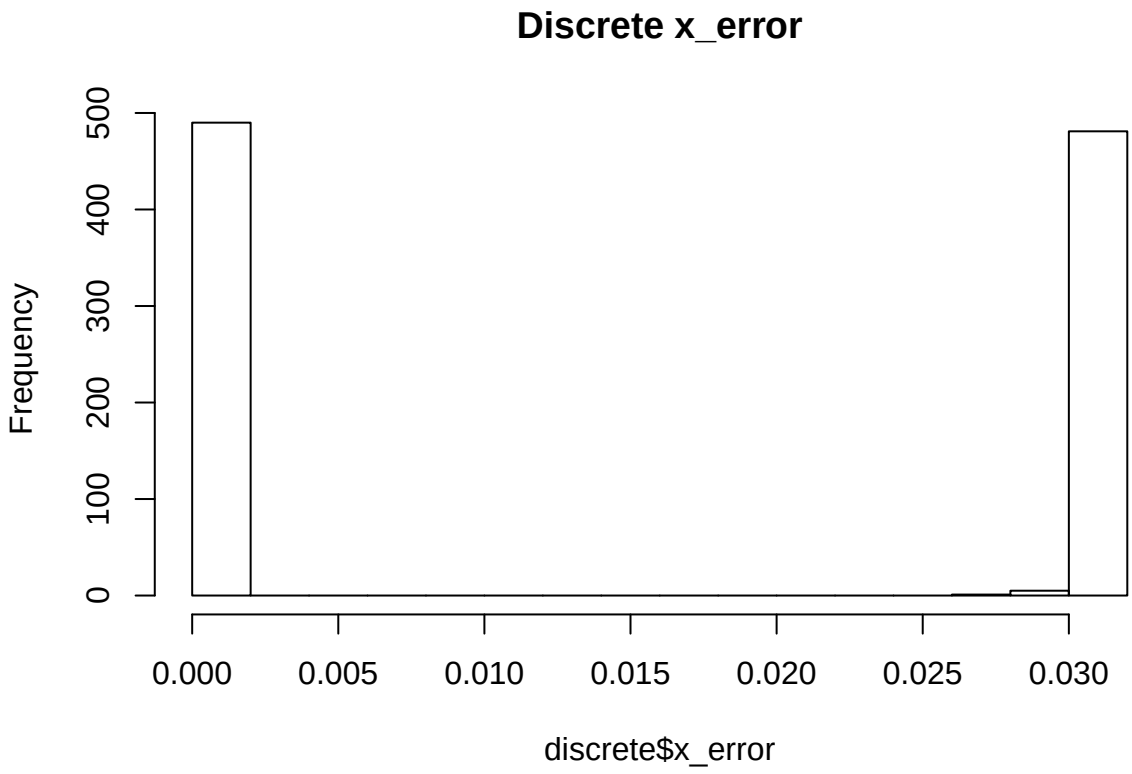

```r
hist(continuous$y_error,
      main = "Continuous y_error")
```



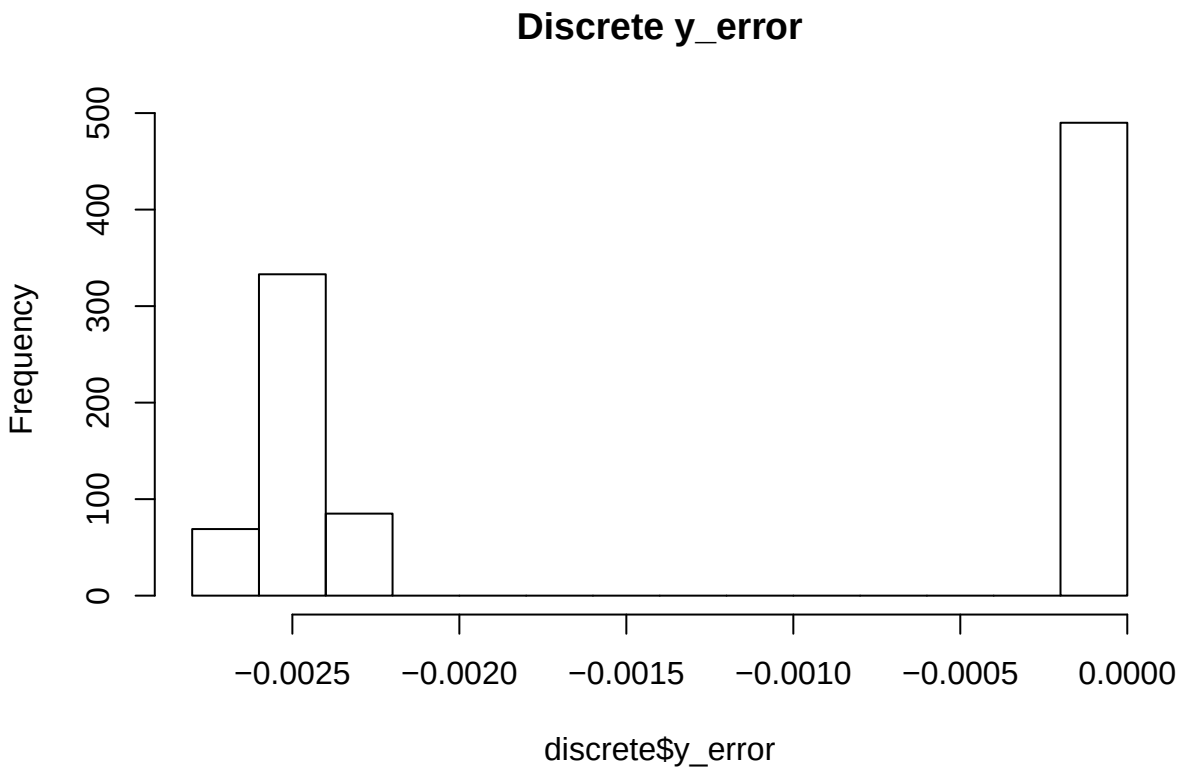
```r
hist(continuous$horizontal_error,
     main = "Continuous total distance error")
```



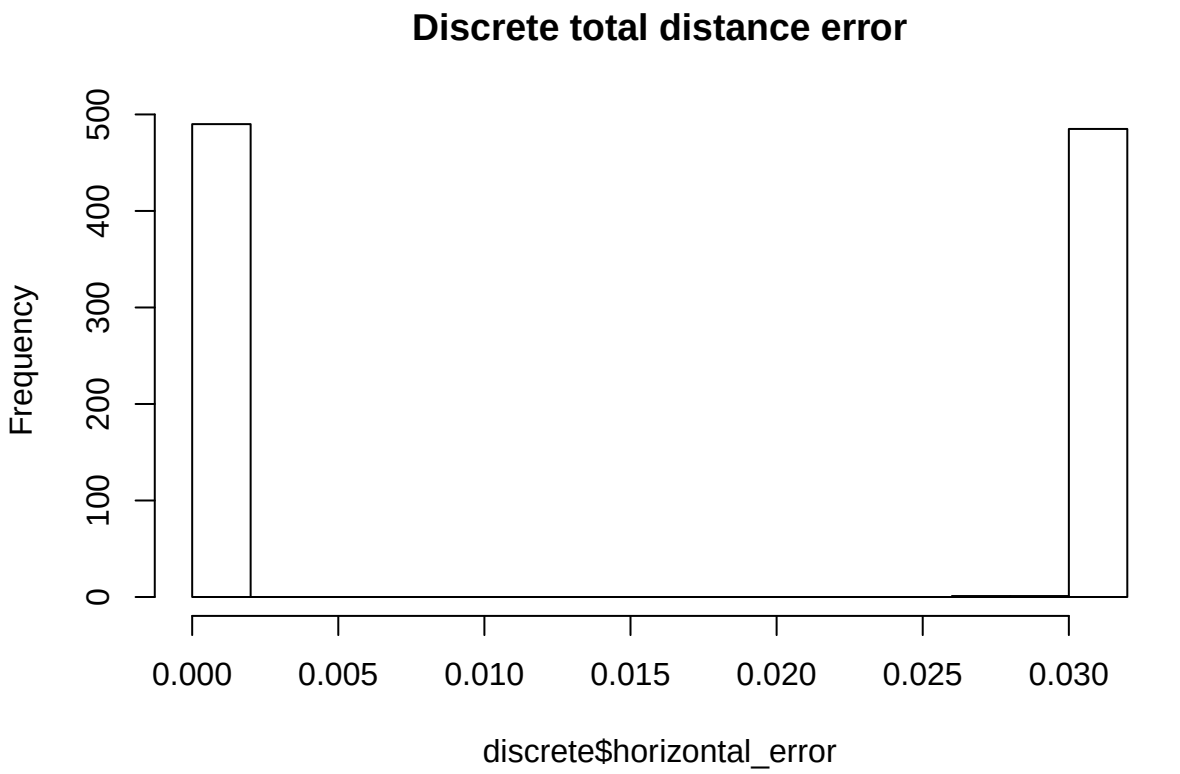

```r
hist(discrete$x_error,
     main = "Discrete x_error")
```



```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 - 04:40:51 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.} & \multi
## \hline \\[-1.8ex]
## x\_position & 977 & 0.997 & 1.001 & $-$0 & 2 \\
## y\_position & 977 & $-$0.000 & 0.000 & $-$0 & 0 \\
## yaw & 977 & $-$0.000 & 0.000 & $-$0 & 0 \\
## x\_variance & 977 & 1.539 & 0.844 & 0.074 & 2.996 \\
## y\_variance & 977 & 1.539 & 0.844 & 0.074 & 2.996 \\
## yaw\_variance & 977 & 1.844 & 1.012 & 0.089 & 3.592 \\
## yaw\_error & 977 & 0.0001 & 0.0002 & $-$0.0002 & 0.0004 \\
## x\_error & 977 & 0.0003 & 0.0001 & 0.00001 & 0.001 \\
```

```
## y\_error & 977 & 0.000 & 0.00000004 & $-$0.00000004 & 0.0000001 \\
## horizontal\_error & 977 & 0.0003 & 0.0001 & 0.00001 & 0.001 \\
## \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.harvard
## % Date and time: Wed, Aug 10, 2016 - 04:40:52 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 & 977 & 0.982 & 0.985 & $-$0.000 & 1.973 \\
## y\_position & 977 & 0.001 & 0.001 & $-$0.00000004 & 0.003 \\
## yaw & 977 & 0.00005 & 0.0001 & $-$0.0001 & 0.0004 \\
## x\_variance & 977 & 0.198 & 0.219 & 0.002 & 0.664 \\
## y\_variance & 977 & 0.198 & 0.219 & 0.002 & 0.664 \\
## yaw\_variance & 977 & 0.380 & 0.172 & 0.089 & 0.692 \\
## x\_error & 977 & 0.015 & 0.015 & 0.00001 & 0.030 \\
## y\_error & 977 & $-$0.001 & 0.001 & $-$0.003 & 0.000 \\
## horizontal\_error & 977 & 0.015 & 0.015 & 0.00001 & 0.030 \\
## yaw\_error & 977 & 0.00001 & 0.00005 & $-$0.0001 & 0.0001 \\
## \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)
}
```