TBL Take Home Test

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```r
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.1.3
```

```r
library(ggforce)
```

```
## Warning: package 'ggforce' was built under R version 4.1.3
```

```r
library(gridExtra)
```

```
## Warning: package 'gridExtra' was built under R version 4.1.3
```

```r
TBL_take_home <- read.csv("C:/Users/nicki/Downloads/take_home.csv")
```

```r
X = TBL_take_home$CoordsX
Y = TBL_take_home$CoordsY
Z = TBL_take_home$CoordsZ
VelX = TBL_take_home$VelX
VelY = TBL_take_home$VelY
VelZ = TBL_take_home$VelZ
AccelX = TBL_take_home$AccelX
AccelY = TBL_take_home$AccelY
AccelZ = TBL_take_home$AccelZ
EntityID =  TBL_take_home$EntityID

team_a <- subset(TBL_take_home, Team == "A")
team_b <- subset(TBL_take_home, Team == "B")
```

##Velocity Scatter

```r
create_scatter_plot <- function(data, title) {
  ggplot(data = data, aes(x = CoordsX, y = CoordsY, color = VelX + VelY)) +
    geom_point(na.rm = TRUE) +
    scale_color_gradient(low = "lightblue", high = "darkblue") +
    labs(color = "Velocity") +
    coord_cartesian(
      xlim = c(0, 100),
      ylim = c(-42.5, 42.5)
```

```
    ) +
    geom_circle(aes(x0 = 69, y0 = -22, r = 15), color = "black", fill = NA) +
    geom_circle(aes(x0 = 69, y0 = 22, r = 15), color = "black", fill = NA) +
     geom_vline(xintercept = 0, linetype = "dashed", size = 1) +        ggtitle(title)
}
```

##Velocity Plots

You can also embed plots, for example:

```
#Team A Velocity
subset_team_a <- subset(TBL_take_home, Team == "A")
plot_team_a <- create_scatter_plot(subset_team_a, "A")
```

```
## Warning: Using 'size' aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use 'linewidth' instead.
## This warning is displayed once every 8 hours.
## Call 'lifecycle::last_lifecycle_warnings()' to see where this warning was
## generated.
```
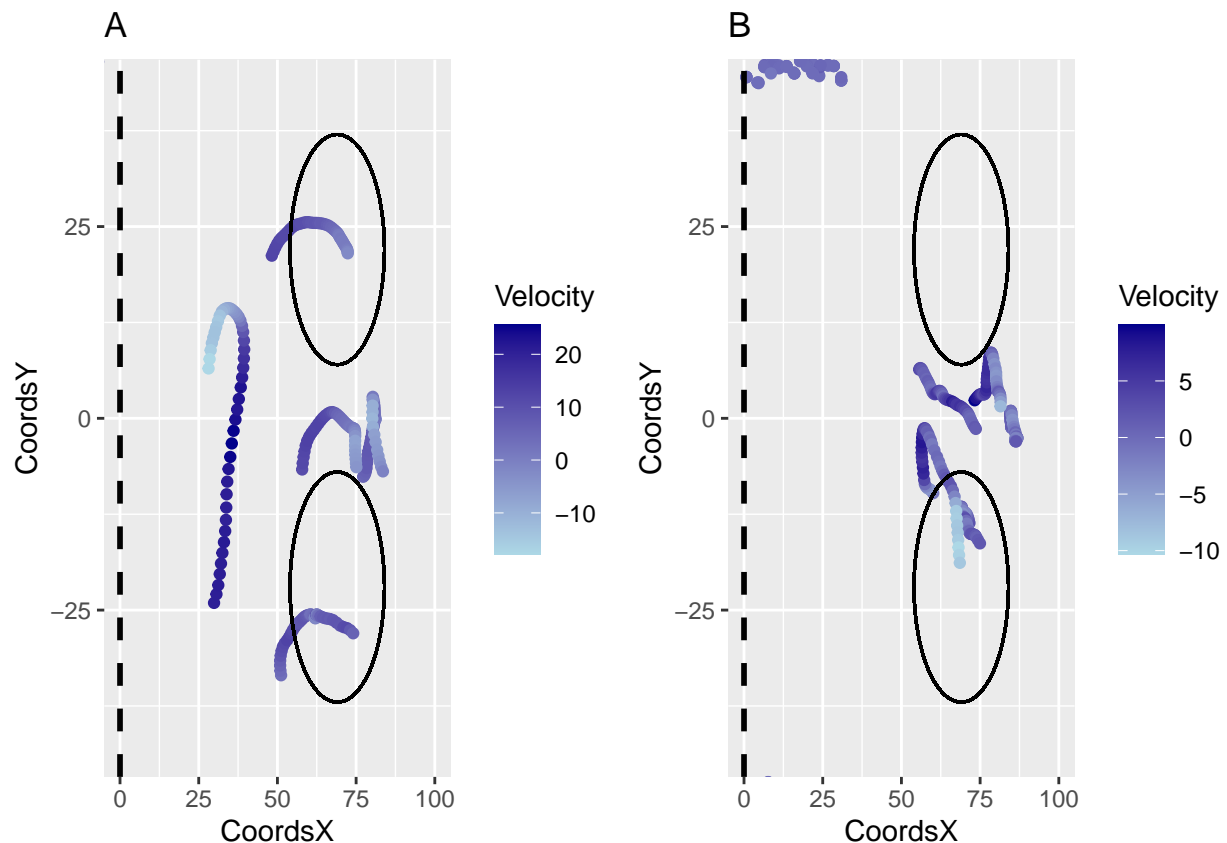
```
#Team B Velocity
subset_team_b <- subset(TBL_take_home, Team == "B")
plot_team_b <- create_scatter_plot(subset_team_b, "B")
```

```
grid.arrange(plot_team_a, plot_team_b, ncol = 2)
```

Scatter with Time

```r
scatter_plot_time <- function(data, title) {
  ggplot(data = data, aes(x = CoordsX, y = CoordsY, color = Time)) +
    geom_point(na.rm = TRUE) +
    scale_color_gradient(low = "lightgreen", high = "darkgreen") +
    labs(color = "Time") +
    coord_cartesian(
      xlim = c(0, 100),
      ylim = c(-42.5, 42.5)
    ) +
    geom_circle(aes(x0 = 69, y0 = -22, r = 15), color = "black", fill = NA) +
    geom_circle(aes(x0 = 69, y0 = 22, r = 15), color = "black", fill = NA) +
    geom_vline(xintercept = 0, linetype = "dashed", size = 1) +
    ggtitle(title)
}

#Team A
time_plot_team_a <- scatter_plot_time(subset_team_a, "A")

#Team B
time_plot_team_b <- scatter_plot_time(subset_team_b, "B")


grid.arrange(time_plot_team_a, time_plot_team_b, plot_team_a, plot_team_b, ncol = 2)
```
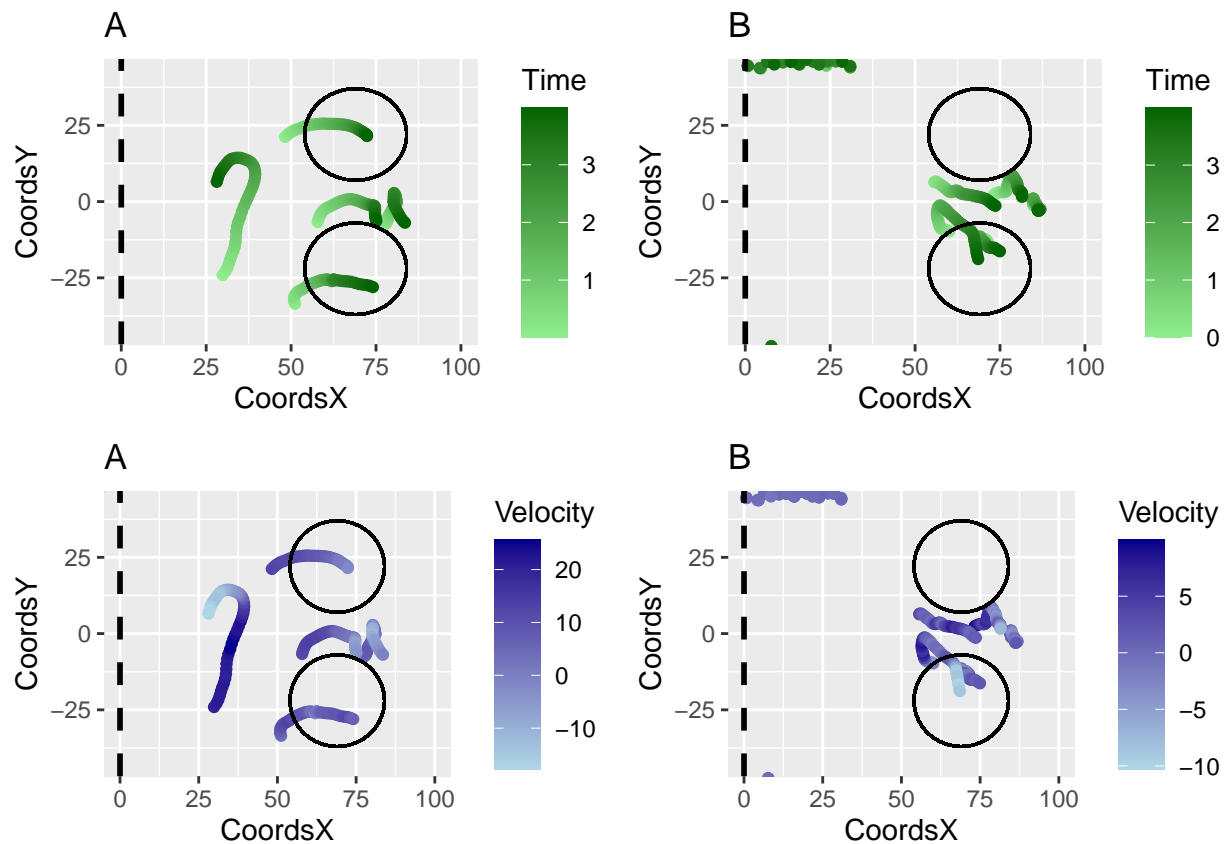
#The graphs above only look at the offensive zone as that is where the current play is happening. It appears Team A is on the Power Play as we can see 5 Team A skaters in an Umbrella formation and most of them are converging towards the net. Team B seems to be collapsed around their goalie and only 4 skaters are on the ice. Also, based on the high skating velocity of Team A's point man, we can infer they were racing to gain control of a loose puck. It sppears that the puck was passed from that point man to the right faceoff dot. Since most of the players on Team A converge towards the net, I assume there was a shot from the right circle and based on the puck path, the shot appears to have been blocked into the right corner.

```
subset_time_1_64 <- subset(TBL_take_home, Time >= 1.6 & Time <= 1.70 & X >= 54 & X <=84 & Y<=-7 & Y>= -
print(subset_time_1_64)
```

```
##      EntityId  CoordsX   CoordsY  CoordsZ       VelX      VelY       VelZ
## 356    14086 58.75772 -25.83472 4.981964 6.3185138 2.2408203 -0.9704978
## 357     8044 68.92669 -11.56398 4.845452 0.9369709 0.9785258 -0.1998942
##         AccelX    AccelY     AccelZ Position JerseyNum Team  Time
## 356 -1.390160 -6.732454 -11.20077       RW        86    A 1.632
## 357 -4.857288 -5.600645 -13.85531        D        44    B 1.636
```

##At Time 1.64 I expect Kucherov(14086) and Team B Jersey Number 44 (8044) to be in the right faceoff dot. Kucherov Coords (X: 58.758, Y: -25.835). Team B #40 coords. (X:68.923, Y: -11.564)

```
subset_entity_1 <- subset(TBL_take_home, EntityId == 1)

plot_entity_1 <- scatter_plot_time(subset_entity_1, "Puck Travel")

velocity_puck <- create_scatter_plot(subset_entity_1, "Velocity of Puck")

# Display the scatter plot for observations where EntityID is 1
grid.arrange(plot_entity_1,velocity_puck)
```

Puck Travel

Velocity of Puck
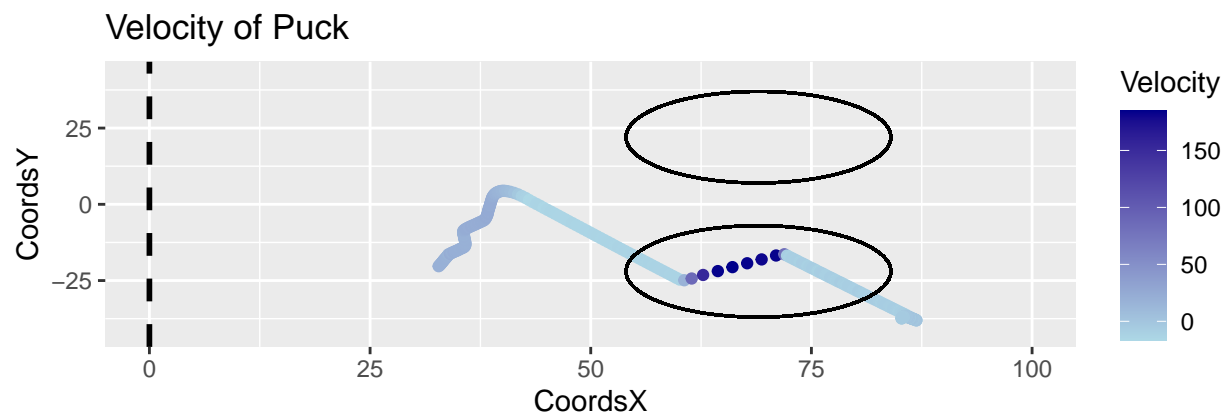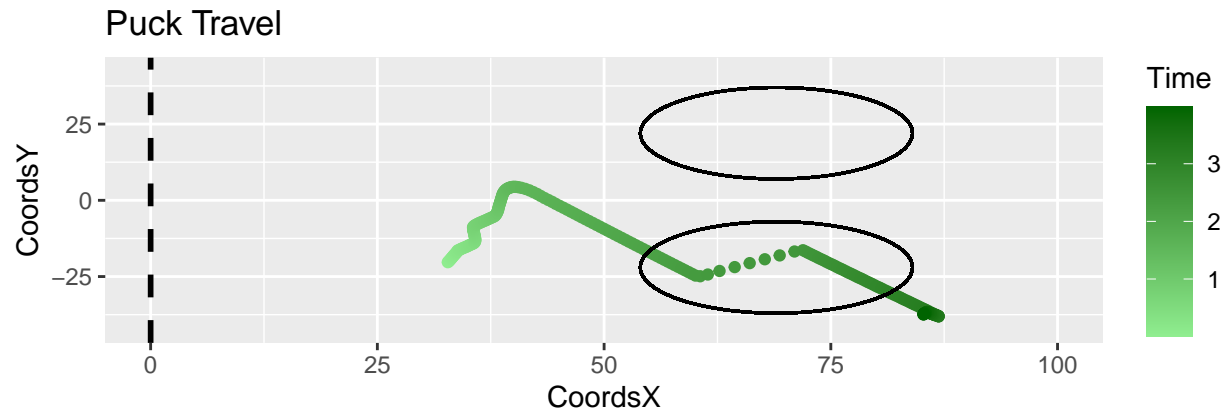

```r
subset_time_164 <- subset(TBL_take_home, EntityId == 1 & Time<=1.65 & Time>= 1.63)

print(subset_time_164)
```

```
##     EntityId  CoordsX  CoordsY CoordsZ     VelX      VelY VelZ    AccelX
## 358        1 43.00768 1.426259       0 24.23568 -40.81793    0 -140.8942
##       AccelY AccelZ Position JerseyNum Team Time
## 358 -171.5984      0                NA      1.64
```

```r
subset_question2 <- subset(TBL_take_home, Time<=1.65 & Time>= 1.63 & X >=43 & X<= 89 & Y <= 1.43 & Y>=0)

print(subset_question2)
```

```
##     EntityId  CoordsX   CoordsY  CoordsZ       VelX       VelY       VelZ
## 358        1 43.00768 1.4262589 0.000000 24.2356772 -40.817931  0.000000
## 359     8034 84.72346 0.9535184 5.198738  0.1466829   1.368064 -1.008279
##            AccelX      AccelY    AccelZ Position JerseyNum Team  Time
## 358 -140.894198 -171.598383  0.000000                NA      1.640
## 359   -1.341155   -8.714046 -3.177618        G        34    B 1.648
```

##Player ID 8034 is in the 10 foot line from the puck to the net, but he is a goalie.

```r
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 4.1.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:gridExtra':
##
##     combine
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
# Filter data for EntityID 10486
subset_entity_10486 <- subset(TBL_take_home, EntityID == 14086)

# Find matching entries based on coordinates
matching_entries <- inner_join(subset_entity_1, subset_entity_10486, by = c("CoordsX"))

# Print matching entries
print(matching_entries)
```

```
##  [1] EntityId.x  CoordsX     CoordsY.x   CoordsZ.x   VelX.x      VelY.x
##  [7] VelZ.x      AccelX.x    AccelY.x    AccelZ.x    Position.x  JerseyNum.x
## [13] Team.x      Time.x      EntityId.y  CoordsY.y   CoordsZ.y   VelX.y
## [19] VelY.y      VelZ.y      AccelX.y    AccelY.y    AccelZ.y    Position.y
## [25] JerseyNum.y Team.y      Time.y
## <0 rows> (or 0-length row.names)
```

##I expect Kuchov to recieve the puck at around 2.5 seconds.

```r
subset_question5 <- subset(TBL_take_home, EntityId ==1 & Time <= 2.43 & Time >= 2.41)
print(subset_question5)
```

```
##     EntityId CoordsX   CoordsY    CoordsZ   VelX    VelY     VelZ    AccelX
## 529        1 67.72177 -19.32743 0.5380106 104.217 79.14005 8.224666 52.38193
##       AccelY   AccelZ Position JerseyNum Team  Time
## 529 -156.1691 201.1952              NA      2.424
```

```r
predict_future_position <- function(initial_coords, initial_velocity, acceleration, time) {
  predicted_x <- initial_coords[1] + initial_velocity[1] * time + 0.5 * acceleration[1] * time^2
  predicted_y <- initial_coords[2] + initial_velocity[2] * time + 0.5 * acceleration[2] * time^2
  predicted_z <- initial_coords[3] + initial_velocity[3] * time + 0.5 * acceleration[3] * time^2
  c(predicted_x, predicted_y, predicted_z)
```

```
}

initial_coords <- c(67.72177, -19.32743, 0.5380106)  # Initial X, Y coordinates
initial_velocity <- c(104.217, 79.14, 8.224666)  # Initial X and Y velocity
acceleration <- c(52.38193, -156.1691, 201.1952)  # X and Y acceleration
time <- 0.19466


predicted_position <- predict_future_position(initial_coords, initial_velocity, acceleration, time)

cat("Predicted Position:",  "X:", predicted_position[1], "Y:" ,predicted_position[2], "Z:" ,predicted_p
```

```
## Predicted Position: X: 89.00109 Y: -6.880858 Z: 5.95092
```

##No, this would have missed the net wide right by about 3.8 feet and was about 2 feet too high