Final Project

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Read in the data

```
library(skimr)

library(ggplot2)
library(dplyr)

library(readr)
ufc <- read_csv("data/ufc-fighters-statistics.csv")
```

Introduction and data

Around 300 million individuals worldwide identify themselves as fans of Mixed Martial Arts (MMA), with its popularity peaking in nations such as the United States, the United Kingdom, Brazil, Singapore, and China. The Ultimate Fighting Championship (UFC) is the premier organization in the MMA world. Our motivation is to research on what contributes to the fighters' performance. Thus, the research questions are: How largely do the innate physical attributes affect fighters' performance? What's the most effective stance? How does the way fighters stroke (speed/accuracy/amount/defence success) influence their performance?

Today's data are UFC fighter statistics including:

wins: The number of wins the fighter has in their career.

draws: The number of draws the fighter has in their career.

height_cm: The height of the fighter in centimeters.

weight_in_kg: The weight of the fighter in kilograms.

reach_in_cm: The reach of the fighter in centimeters.

stance: The fighting stance of the fighter (Orthodox/Southpaw/Switch).

significant_strikes_landed_per_minute: The average number of significant strikes landed by the fighter per minute.

significant_striking_accuracy: The percentage of significant strikes that land successfully for the fighter.

significant_strikes_absorbed_per_minute: The average number of significant strikes absorbed by the fighter per minute.

significant_strike_defence: The percentage of opponent's significant strikes that the fighter successfully defends.

average_takedowns_landed_per_15_minutes: The average number of takedowns landed by the fighter per 15 minutes.

takedown_accuracy: The percentage of takedown attempts that are successful for the fighter.

takedown_defense: The percentage of opponent's takedown attempts that the fighter successfully defends.

average_submissions_attempted_per_15_minutes: The average number of submission attempts made by the fighter per 15 minutes.

Our response variable is wins, predictors are

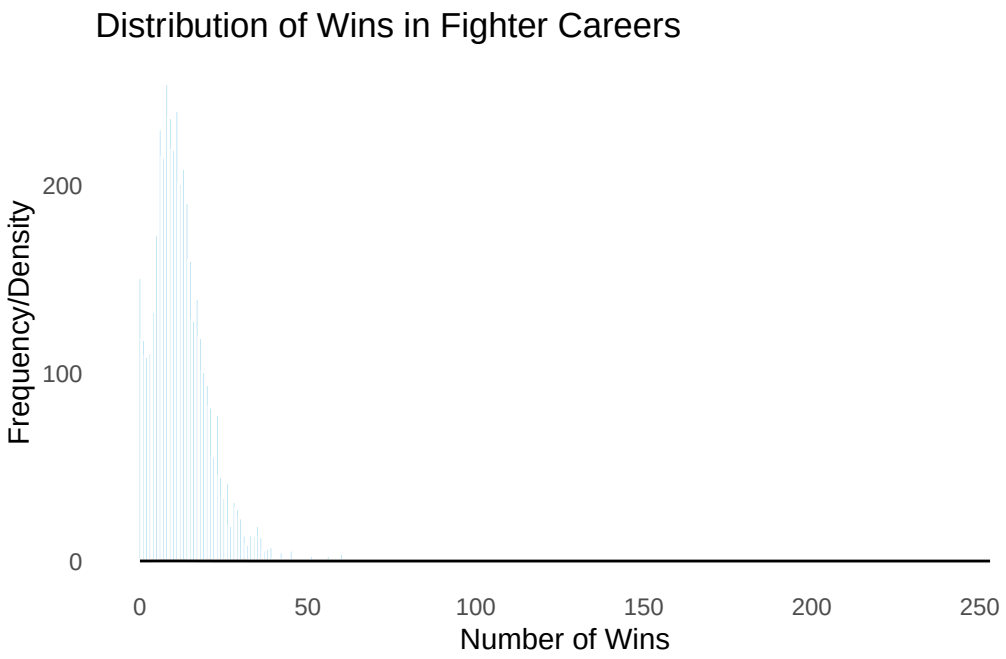
sources:

https://www.kaggle.com/datasets/aaronfriasr/ufc-fighters-statistics?resource=download

https://www.euronews.com/business/2023/09/27/the-booming-billion-dollar-business-of-combat-sports

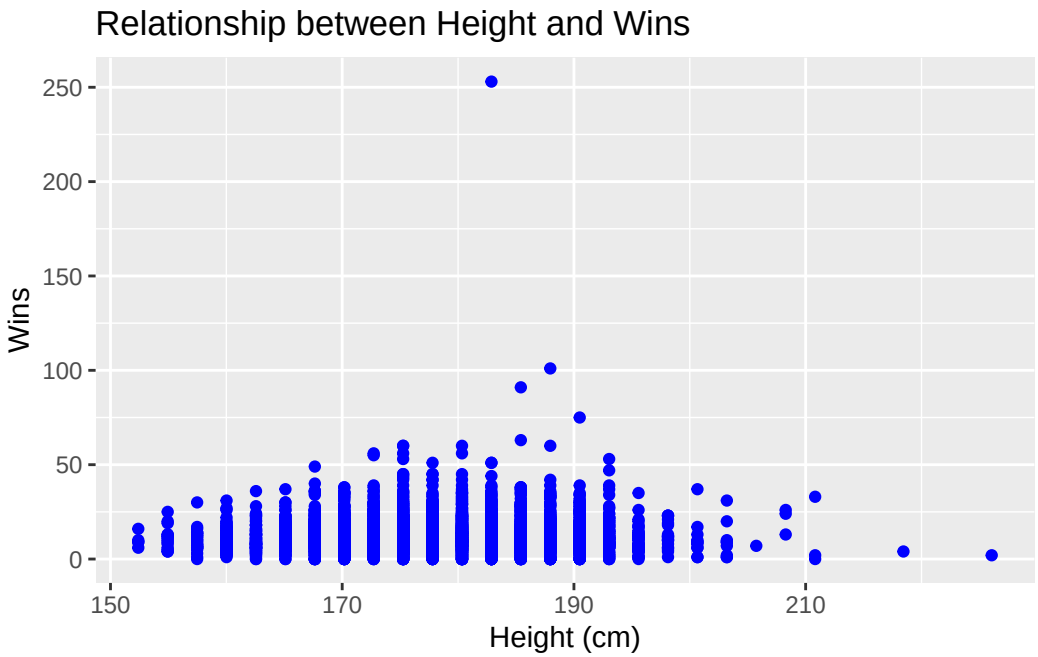
EDA

```
library(ggplot2)

plot <- ggplot(ufc, aes(x = wins)) +
        geom_histogram(binwidth = 1, fill = "skyblue", color = "white") +
        geom_density(alpha = 0.5, fill = "skyblue") +
        labs(x = "Number of Wins", y = "Frequency/Density",
             title = "Distribution of Wins in Fighter Careers") +
        theme_minimal() +
        theme(panel.grid = element_blank())

print(plot)
```



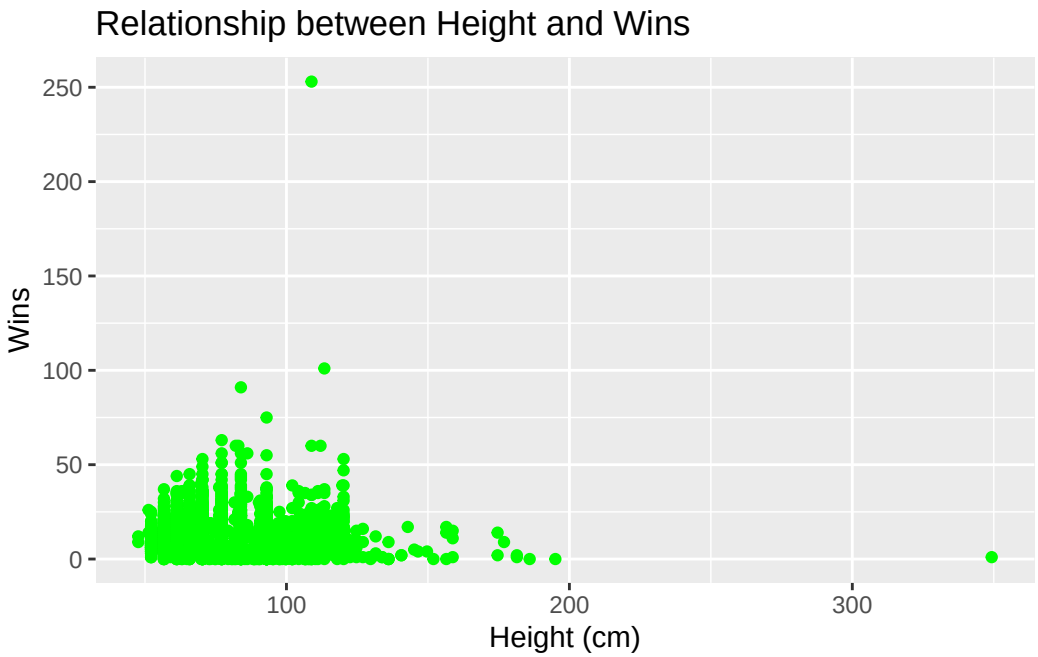

```
plot_height <- ggplot(ufc, aes(x = height_cm, y = wins)) +
               geom_point(color = "blue") +
               labs(x = "Height (cm)", y = "Wins",
                    title = "Relationship between Height and Wins")

print(plot_height)
```

```
Warning: Removed 298 rows containing missing values (`geom_point()`).
```



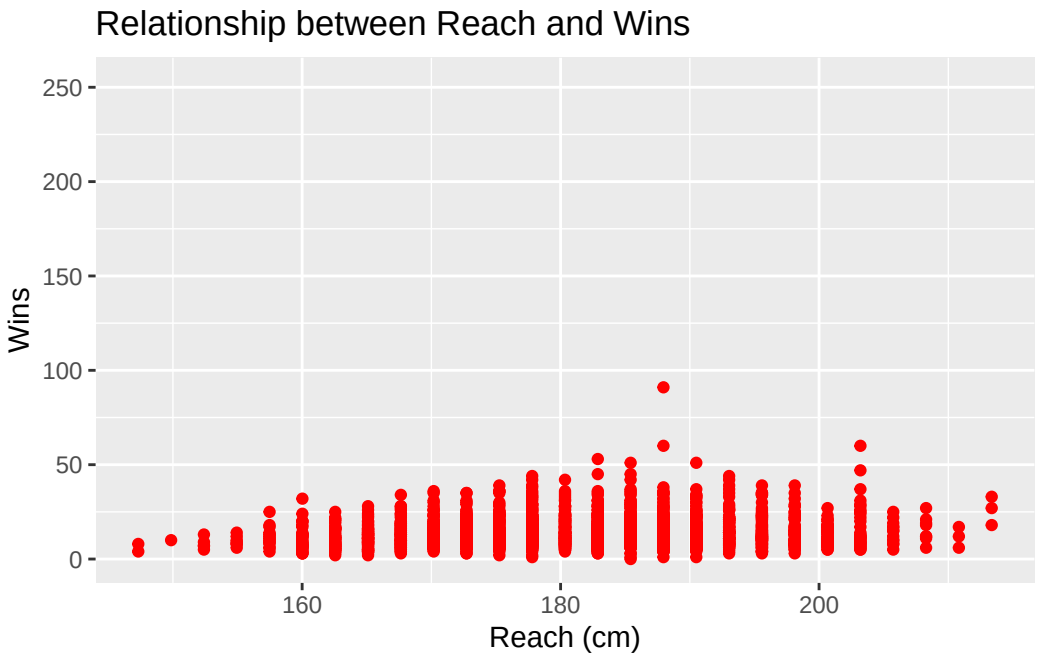

```
plot_weight <- ggplot(ufc, aes(x = weight_in_kg, y = wins)) +
               geom_point(color = "green") +
               labs(x = "Height (cm)", y = "Wins",
                    title = "Relationship between Height and Wins")

print(plot_weight)
```

```
Warning: Removed 87 rows containing missing values (`geom_point()`).
```




```
plot_reach <- ggplot(ufc, aes(x = reach_in_cm, y = wins)) +
              geom_point(color = "red") +
              labs(x = "Reach (cm)", y = "Wins",
                   title = "Relationship between Reach and Wins")
print(plot_reach)
```

```
Warning: Removed 1927 rows containing missing values (`geom_point()`).
```



Data Preparation

```
ufc$win_ratio <- ufc$wins / (ufc$wins + ufc$losses + ufc$draws)

print(head(ufc))
```

```
# A tibble: 6 x 19
  name     nickname  wins losses draws height_cm weight_in_kg reach_in_cm stance
  <chr>    <chr>    <dbl>  <dbl> <dbl>     <dbl>        <dbl>       <dbl> <chr>
1 Robert ~ <NA>         7      0     0      190.         93.0         NA  Ortho~
2 Daniel ~ The Ani~    15     37     0      185.         83.9         NA  <NA>
3 Dan Mol~ <NA>        13      9     0      178.         98.0         NA  <NA>
4 Paul Ru~ <NA>         7      4     0      168.         61.2         NA  <NA>
5 Collin ~ All In       8      2     0      190.         83.9        193. Ortho~
6 Gerald ~ The Fin~     9      7     0      175.         70.3         NA  Ortho~
# i 10 more variables: date_of_birth <date>,
#   significant_strikes_landed_per_minute <dbl>,
#   significant_striking_accuracy <dbl>,
#   significant_strikes_absorbed_per_minute <dbl>,
#   significant_strike_defence <dbl>,
#   average_takedowns_landed_per_15_minutes <dbl>, takedown_accuracy <dbl>,
```

```
#   takedown_defense <dbl>, ...
```

```
skim(ufc)
```

Table 1: Data summary

Name	ufc
Number of rows	4111
Number of columns	19
_____	
Column type frequency:	
character	3
Date	1
numeric	15
_____	
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
name	0	1.00	5	27	0	4105	0
nickname	1854	0.55	1	30	0	1784	0
stance	823	0.80	6	11	0	5	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date_of_birth	1135	0.72	1943-01-25	2004-10-08	1986-11-06	2565

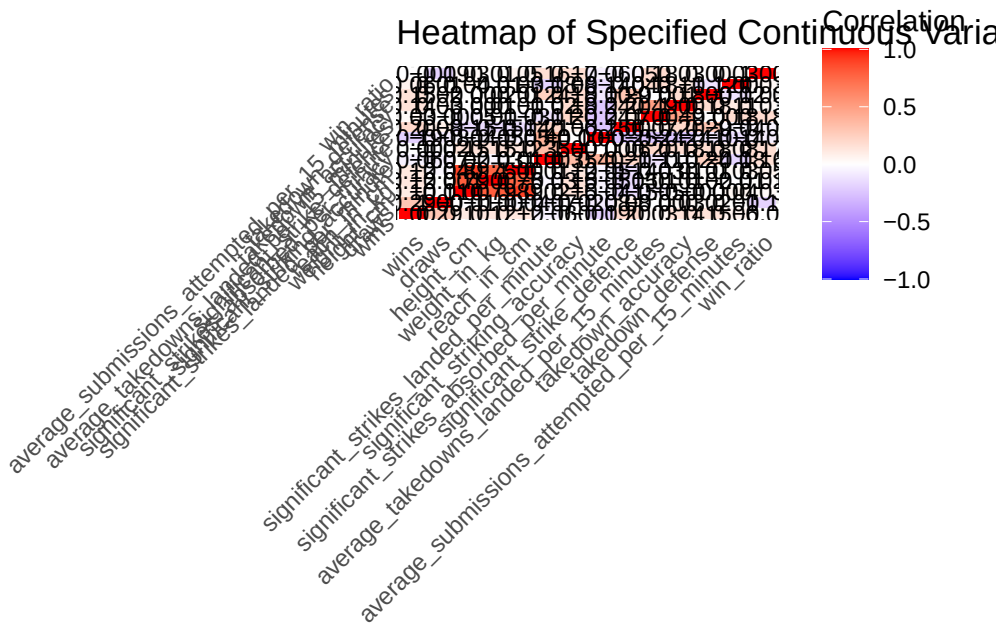
Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
wins	0	1.00	12.37	9.37	0.00	7.00	11.00	17.00	253.00	
losses	0	1.00	5.73	5.10	0.00	2.00	5.00	8.00	83.00	
draws	0	1.00	0.26	0.82	0.00	0.00	0.00	0.00	11.00	
height_cm	298	0.93	178.23	8.89	152.40	172.72	177.80	185.42	226.06	
weight_in_kg	87	0.98	77.40	17.98	47.63	65.77	77.11	83.91	349.27	
reach_in_cm	1927	0.53	181.81	10.68	147.32	175.26	182.88	190.50	213.36	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
significant_strikes_landed_per_minute	0	1.00	2.44	1.99	0.00	0.83	2.33	3.60	17.65	
significant_striking_accuracy	0	1.00	35.54	20.40	0.00	27.00	40.00	49.00	100.00	
significant_strikes_absorbed_per_minute	0	1.00	3.15	2.85	0.00	1.55	2.94	4.23	52.50	
significant_strike_defence	0	1.00	42.64	22.32	0.00	36.00	50.00	58.00	100.00	
average_takedowns_landed_per_15_minutes	0	1.00	1.25	1.94	0.00	0.00	0.59	1.94	32.14	
takedown_accuracy	0	1.00	26.30	28.70	0.00	0.00	22.00	45.00	100.00	
takedown_defense	0	1.00	38.96	34.43	0.00	0.00	42.00	66.00	100.00	
average_submissions_attempted_per_15_minutes	0	1.00	0.61	1.51	0.00	0.00	0.00	0.70	21.90	
win_ratio	19	1.00	0.66	0.19	0.00	0.60	0.69	0.78	1.00	

Choose Predictors

```
# Select specified continuous columns
selected_columns <- ufc %>%
  select(wins, draws, height_cm, weight_in_kg, reach_in_cm, significant_strikes_landed_per
         significant_striking_accuracy, significant_strikes_absorbed_per_minute,
         significant_strike_defence, average_takedowns_landed_per_15_minutes,
         takedown_accuracy, takedown_defense, average_submissions_attempted_per_15_minutes

# Compute the correlation matrix
correlation_matrix <- cor(selected_columns, use = "complete.obs")  # Handles NA by excludi

# Convert the correlation matrix to a long format for ggplot
correlation_data <- as.data.frame(as.table(correlation_matrix))

# Rename columns for clarity
names(correlation_data) <- c("variable1", "variable2", "value")

# Plotting the heatmap
ggplot(correlation_data, aes(x = variable1, y = variable2, fill = value)) +
  geom_tile() +  # This creates the heatmap tiles
  geom_text(aes(label = sprintf("%.2f", value)), color = "black", size = 3) +  # Adds text
  scale_fill_gradient2(low = "blue", high = "red", mid = "white", midpoint = 0, limit = c(
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1),
        axis.text.y = element_text(angle = 45, vjust = 1)) +  # Adjust text alignment if n
  labs(title = "Heatmap of Specified Continuous Variables", x = "", y = "")
```


Heatmap of Specified Continuous Varia
Correlation
1.0
0.5
0.0
−0.5
−1.0
wins
draws
height_cm
height_in_kg
reach_in_cm
weight_in_kg
significant_strikes_landed_per_minute
significant_striking_accuracy
significant_strikes_absorbed_per_minute
average_takedowns_landed_per_15_minutes
significant_strike_defence
takedown_accuracy
takedown_defense
average_submissions_attempted_per_15_minutes
win_ratio