Project Proposal

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```
library(tidyverse)
library(tidymodels)
library(ggplot2)
library(dplyr)

# add code to load data
pokemon <- read.csv("data/pokemon.csv")
```

Introduction

The expansive world of Pokémon, at its core, is a children's game. However, a deeper look at the numbers and statistics the game is built from reveals several intricate relationships among the different pokémons' characteristics. Each creature has its own specific set of base statistics, colloquially referred to as "base stats," including attack, special attack, defense, special defense, and speed, which indicate that pokémon's battle prowess. Summing these stats yields a pokémon's total base stats, which is the best measure of a pokémon's overall strength when all pokémon are put at an even playing field – common knowledge for any pokémon fan. We are interested in measuring a pokémon's strength without using base stats as predictors, giving us insight on how strong the relationships among pokémon's different characteristics actually are. Thus, we are looking to answer the following research question: **Can we predict a Pokémon's Base Stat Total from other variables?** In other words, we are analyzing how well variables such as the pokémon's type, capture rate, growth rate, generation, height, weight, base happiness, weaknesses, and if the pokemon is legendary or not can predict a pokémon's total base stats. We hypothesize that a multiple linear regression model including some formation of these predictor variables will be a somewhat strong predictor base_total – thinking about the game, stronger pokémon would seem to have certain values for these predictor variables when compared to weaker ones: for example, legendary pokémon tend to be stronger in battle than non legendary pokémon, so we might expect is_legendary to be a useful predictor for base_total, for example.

Data description

We retrieved the dataset from kaggle.com, a large data science online community, and the dataset is called "The Complete Pokemon Dataset" created by Rounak Banik in 2017. The dataset was retrieved via web scraper from the website serebii.net, an all-in-one, reliable data hub for all things pokemon in 2017. Since it was formed in 2017, the dataset does not include pokémon from more recent games, but still includes a whopping 801 pokémon, meaning the dataset has 801 observations, one for each pokémon. The dataset contains the following variables, taken directly from the kaggle website for the dataset:

- name: The English name of the Pokemon
- japanese_name: The Original Japanese name of the Pokemon
- pokedex_number: The entry number of the Pokemon in the National Pokedex
- percentage_male: The percentage of the species that are male. Blank if the Pokemon is genderless.
- type1: The Primary Type of the Pokemon (every pokémon has this)
- type2: The Secondary Type of the Pokemon (not all pokémon have this)
- classification: The Classification of the Pokemon as described by the Sun and Moon Pokedex
- height_m: Height of the Pokemon in meters
- weight_kg: The Weight of the Pokemon in kilograms
- capture_rate: Capture Rate of the Pokemon
- base_egg_steps: The number of steps required to hatch an egg of the Pokemon
- abilities: A stringified list of abilities that the Pokemon is capable of having
- experience_growth: The Experience Growth of the Pokemon
- base_happiness: Base Happiness of the Pokemon
- against_?: Eighteen features that denote the amount of damage taken against an attack of a particular type (18 of these, one for each type)
- hp: The Base HP of the Pokemon
- attack: The Base Attack of the Pokemon
- defense: The Base Defense of the Pokemon
- sp_attack: The Base Special Attack of the Pokemon
- sp_defense: The Base Special Defense of the Pokemon

- speed: The Base Speed of the Pokemon
- generation: The numbered generation which the Pokemon was first introduced
- is_legendary: Denotes if the Pokemon is legendary.

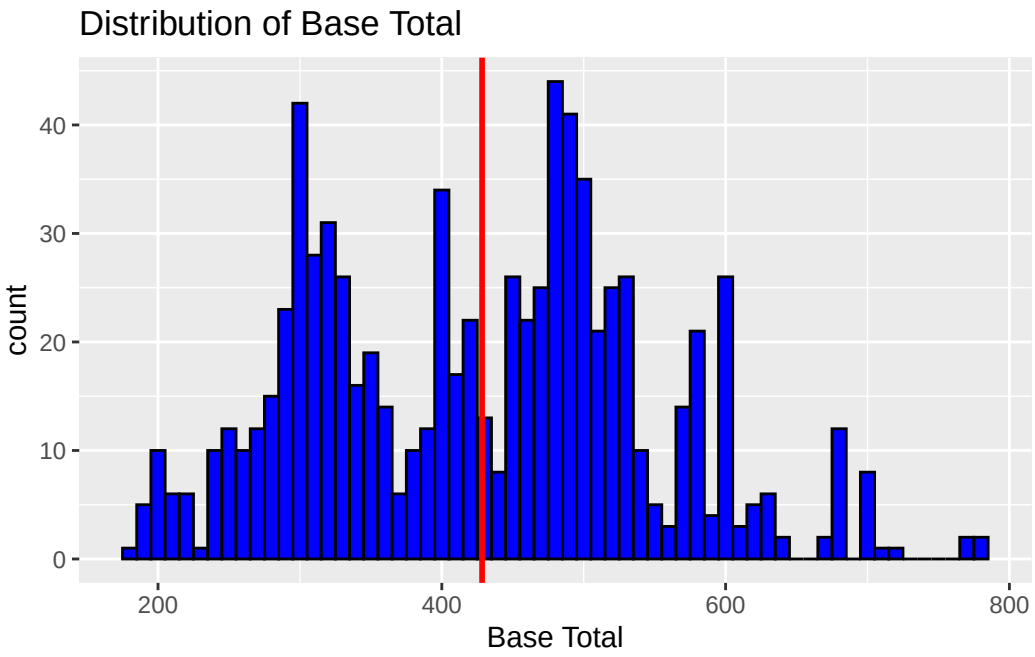
Source: (https://www.kaggle.com/datasets/rounakbanik/pokemon/)

As you'll notice, the dataset splits the base stats of each pokemon into the individual stats, but we only need to know about the base_total variable, which is included in the csv file. Each variable describes the pokémon at hand in a different way. Some, like is_legendary, may prove to be extremely important in our regression model, while with others, like name and Japanese name, we can remove them from consideration as they are simply unique identifiers.

Initial exploratory data analysis

Distribution of the response variable (base total):

```
ggplot(pokemon, aes(x = base_total)) +
  geom_histogram(binwidth = 10, fill = "blue", color = "black") +
  geom_vline(xintercept = mean(pokemon$base_total), color = "red", size = 1) +
  labs(title = "Distribution of Base Total", x = "Base Total")
```



```r
summary(pokemon$base_total)
```

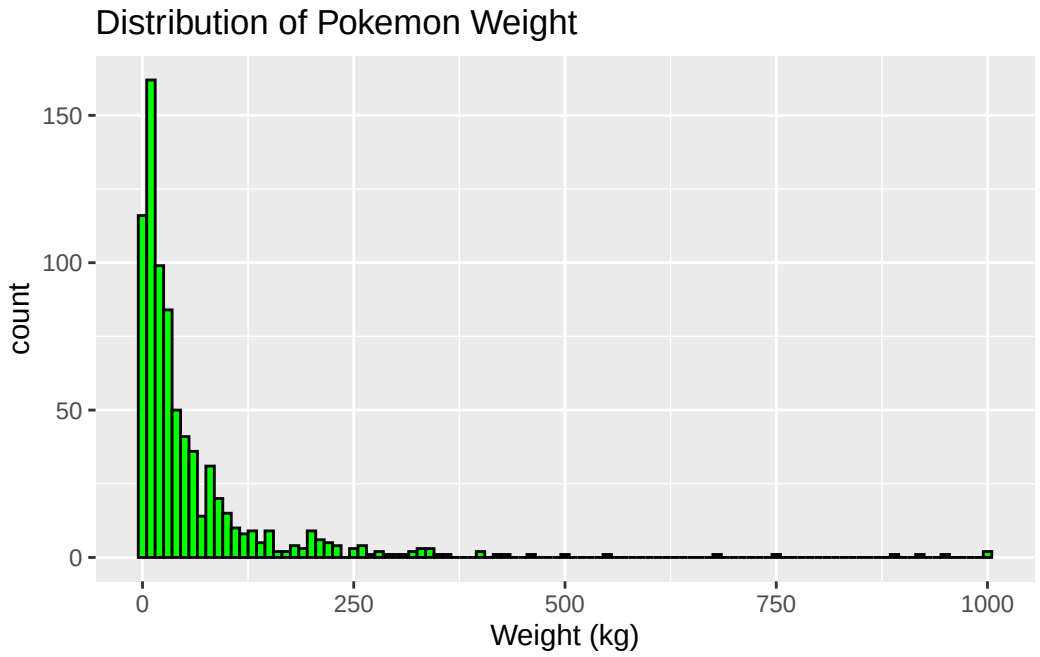
```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  180.0   320.0   435.0   428.4   505.0   780.0
```

Description:

Distributions of one potential quantitative predictor variable and one potential categorical predictor variable:

- **Weight(quantitative predictor):**

```r
ggplot(pokemon, aes(x = weight_kg)) +
  geom_histogram(binwidth = 10, fill = "green", color = "black") +
  labs(title = "Distribution of Pokemon Weight", x = "Weight (kg)")
```




```r
summary(pokemon$weight_kg)
```

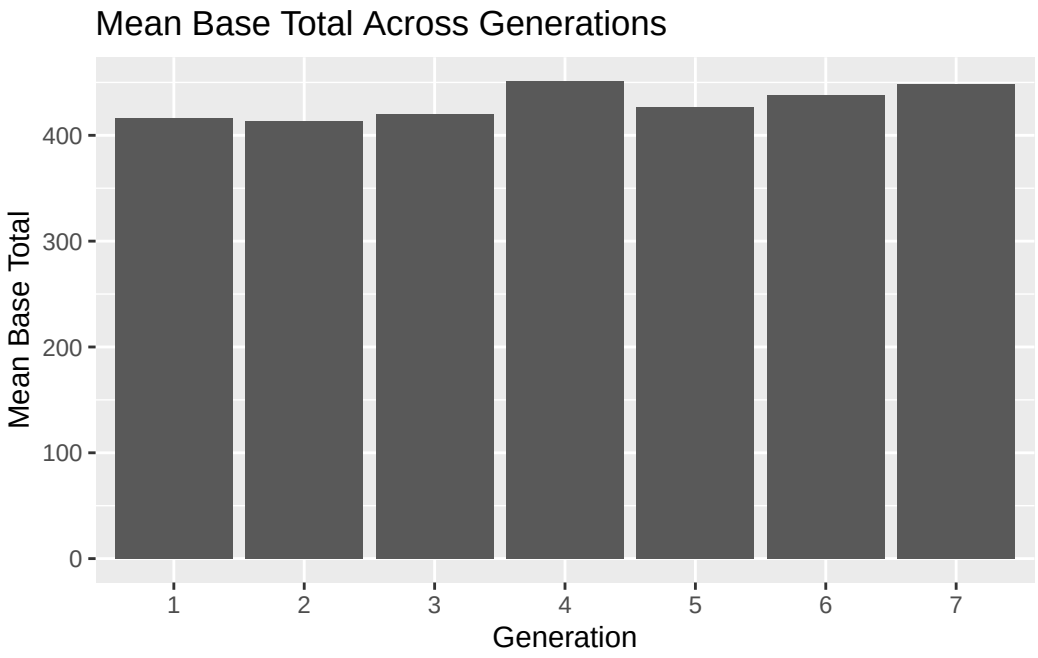
```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
   0.10    9.00   27.30   61.38   64.80  999.90      20
```

ADD DESC HERE BRIAN

- **Generation(qualitative predictor):**

```
generation_means <- pokemon |>
  group_by(generation) |>
  summarise(mean_base_total = mean(base_total)) |>
  arrange(desc(mean_base_total))

ggplot(generation_means, aes(x = as.factor(generation), y = mean_base_total)) +
  geom_bar(stat = "identity", show.legend = FALSE) +
  labs(title = "Mean Base Total Across Generations",
       x = "Generation",
       y = "Mean Base Total")
```



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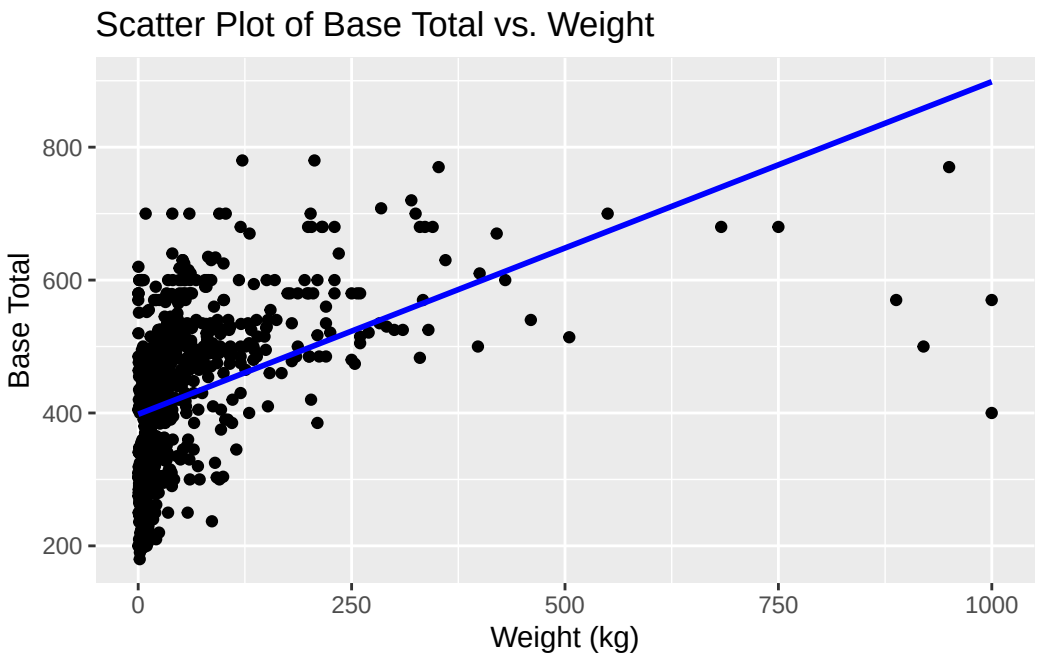
Relationships between response and predictor from above:

- **Weight and Base Total:**

```r
ggplot(pokemon, aes(x = weight_kg, y = base_total)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE, col = "blue") +
  labs(title = "Scatter Plot of Base Total vs. Weight", x = "Weight (kg)", y = "Base Total
```



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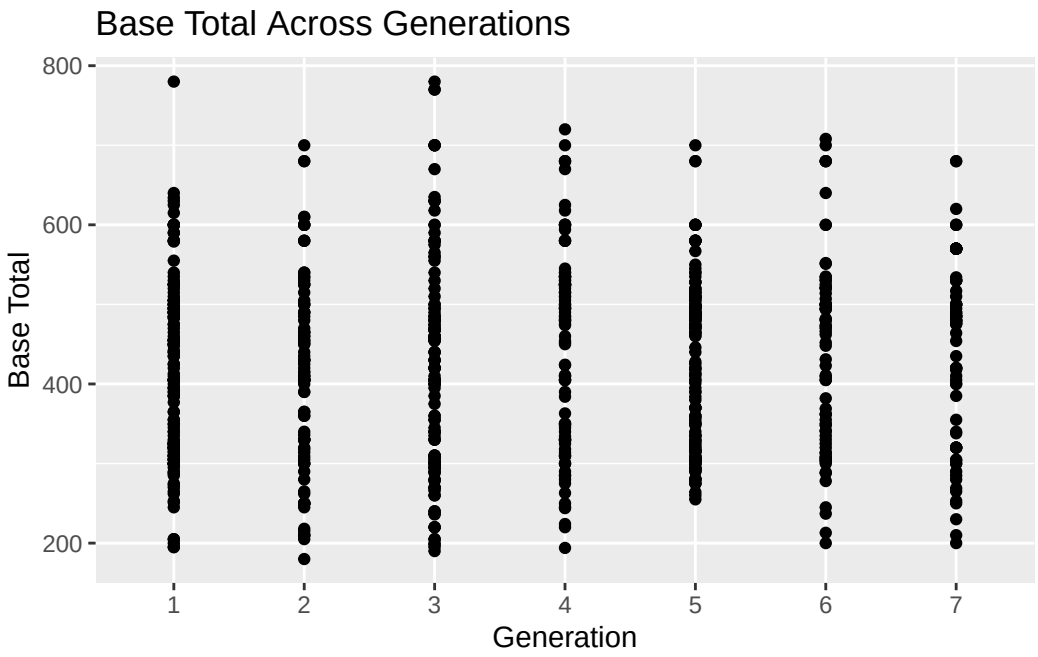
- **Base Total and Generation:**

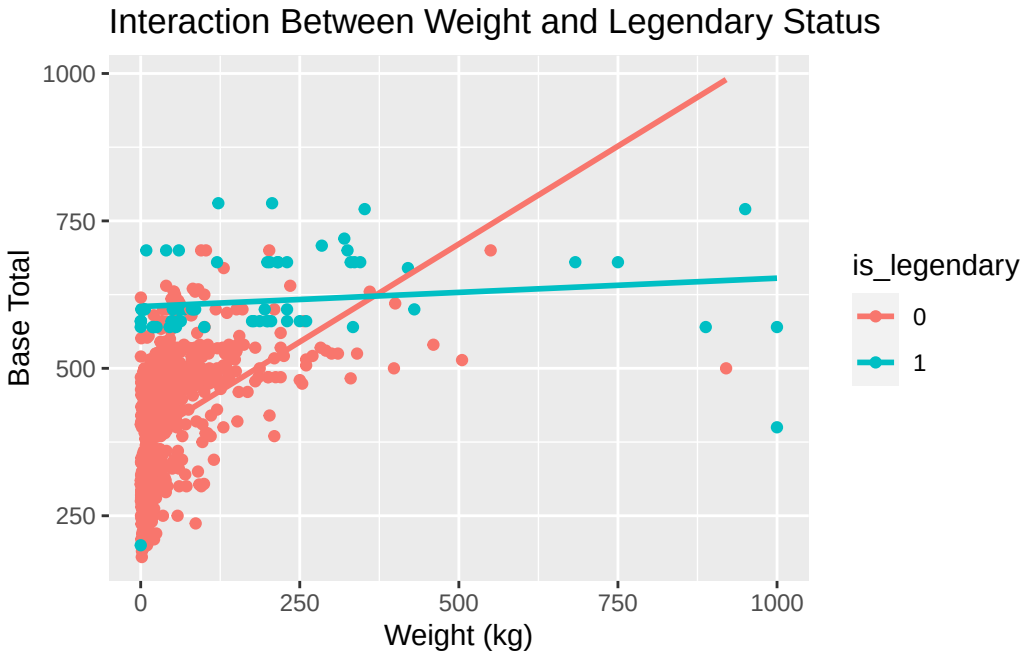
```r
ggplot(pokemon, aes(x = as.factor(generation), y = base_total)) +
  geom_point() +
  labs(title = "Base Total Across Generations",
       x = "Generation",
       y = "Base Total")
```



ADD DESC HERE AND MAYBE COR?

Potential Interaction Effect (Base total and is legendary):

```
pokemon$is_legendary <- as.factor(pokemon$is_legendary)
ggplot(pokemon, aes(x = weight_kg, y = base_total, color = is_legendary)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Interaction Between Weight and Legendary Status", x = "Weight (kg)", y = "
```



ADD DESC HERE AND MENTION THE AS FACTOR PART OF CODE

Analysis approach

The response variable is **base_total**, which is the total of all base stats (attack, special attack, defense, special defense, speed, and hitpoints) for a given pokémon. It is a generally great measure of a pokémon's strength.

The potential predictor variables include:

- percentage_male
- type1
- type2
- height_m
- weight_kg
- capture_rate
- base_egg_steps
- abilities
- experience_growth

- base_happiness
- against_? (18 of these, one for each type)
- generation
- is_legendary

As our output variable is quantitative and we have several predictor variables, the regression model we are using is **multiple linear regression**.

Data dictionary

The data dictionary can be found here