A Statistical Analysis of Pokémon Competitive Viability

STA210 Final Project

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Introduction

With over 480 million sales worldwide, Pokémon, short for Pocket Monsters, is one of the most successful game series in the world. Spanning 122 installations and roughly 28 years, the Pokémon games generally revolve around catching, training, and battling fictional creatures called "Pokémon" in a quest to become the Pokémon Champion, creating an entertaining gameplay experience for children and adults alike. Despite its simple premise and cartoon aesthetics, Pokémon is home to a rich competitive scene which has continued to grow and evolve since the establishment of the official Pokémon tournament circuit (Video Game Championships, or VGC) in 2009.

At the heart of this community is Smogon, an online hub which has been hosting competitions, forums, and strategy guides since the early 2000s. Above all, Smogon's greatest contribution to the competitive scene comes in the form of its widely respected tiering system, forming the basis on which most competitive online play is based. These tiers, ranging from OU (OverUsed) to PU (Perfectly Useless) are based on Pokémon usage rates and dictate which Pokémon are allowed in different game modes, with more powerful Pokémon residing in the higher tiers and lesser used Pokémon inhabiting the lower tiers. At the top lies AG (anything goes) and Ubers, including Pokémon like Arceus and Rayquaza which are typically banned from online play. On the other hand, LC (Little Cup) and NFE (Not Fully Evolved) consist of unevolved, statistically weak pokemon which are not typically used in normal online play.

Our Data

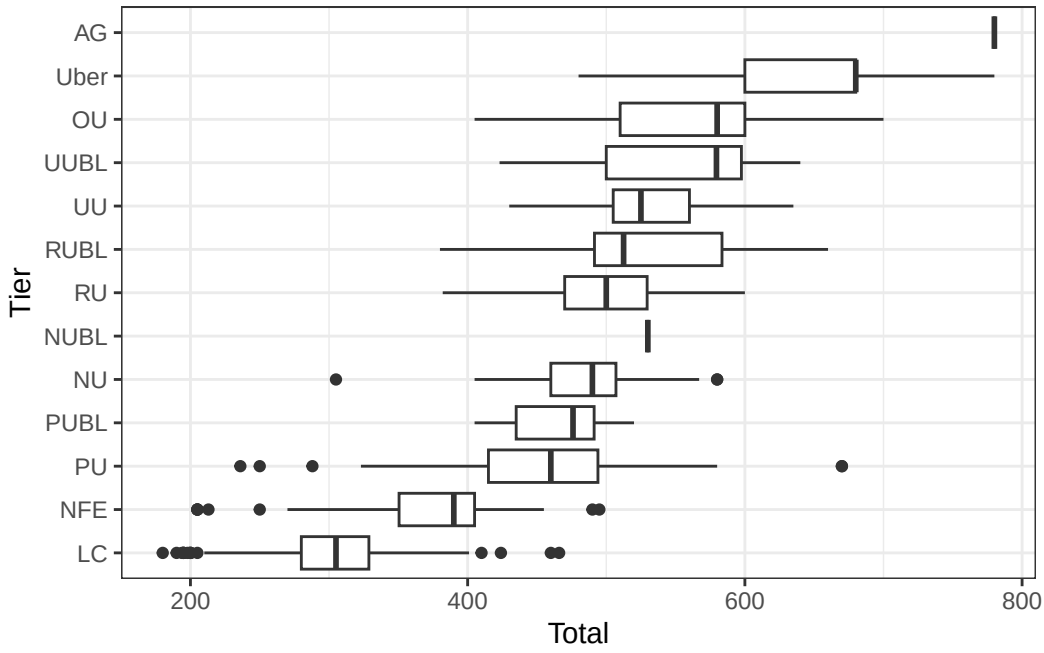
Due to a lack of available modern data, the two datasets used in this report come from Generation 6 of the Pokémon games, which includes the X/Y and Omega Ruby/Alpha Sapphire games. The 'smogon' dataset features 499 observations and 21 columns which include all Pokémon in and above the PU (Perfectly Useless) tier.

To include the Pokémon that were missing from this dataset (those below the PU tier), a subset of missing Pokémon was taken from the 'pokemon' dataset. This data was cleaned by changing all variable names and removing unnecessary variables, then merged with the original dataset to create the updated 'smogon' data frame used throughout this project. The data was then further cleaned by giving the NFE and LC Pokémon their respective tiers and releveling the 'Tier' variable to reflect the actual ordering. Important variables in this data frame include:

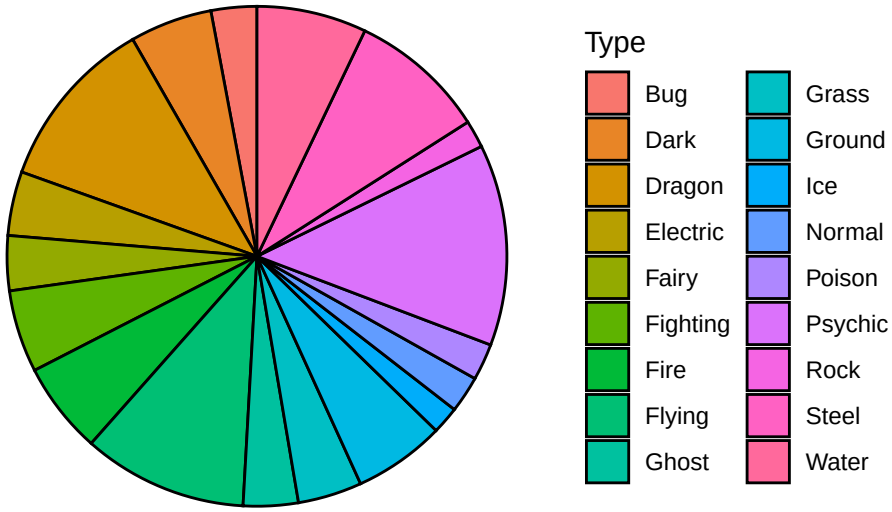
- **HP, Attack, Sp. Atk, Defense, Sp. Def, and Speed**: 6 continuous variables representing a Pokémon's 6 in-game stats
- **Type.1, Type.2**: categorical variables which reflect the type(s) a Pokémon has (e.g. fire, water, grass, etc.)
- **Legendary/Mega**: boolean variables representing whether or not a Pokémon is Legendary (one of a kind in-game) or a Mega form
- **Tier** categorical variable storing the competitive tier (LC to AG) a Pokémon was placed in by Smogon

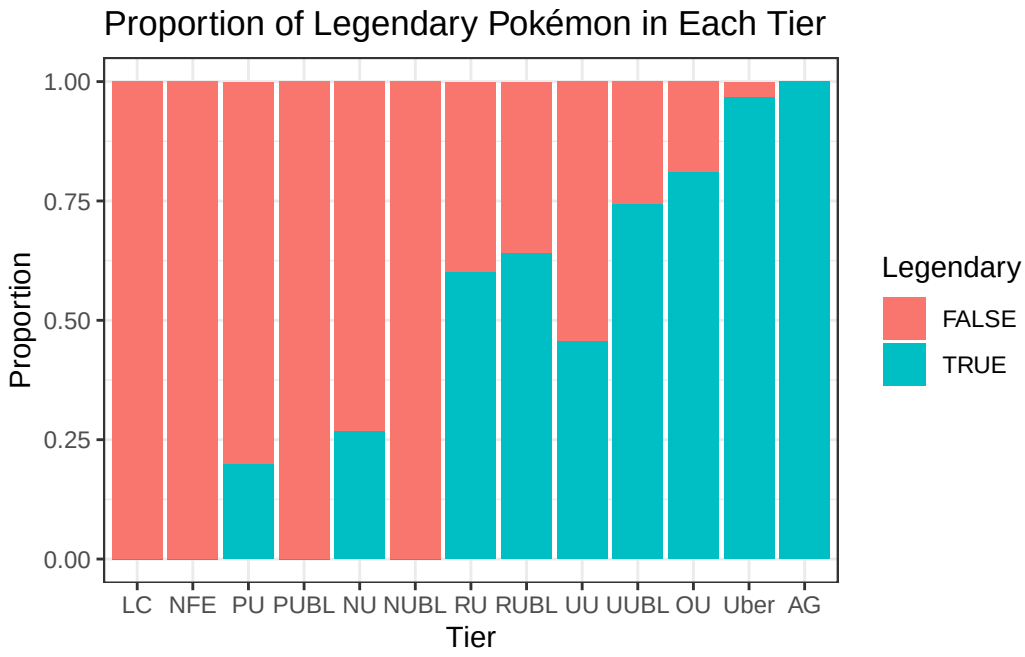
Exploratory Data Analysis

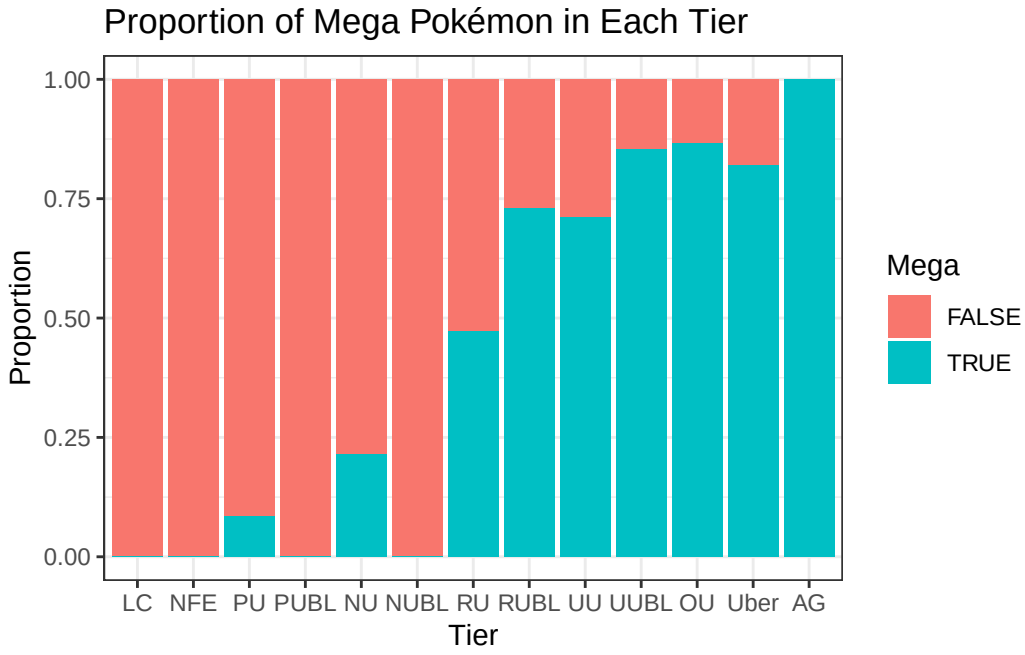
This study seeks to analyze how factors such as stats, typing, and Mega/Legendary status impact a Pokémon's competitive rank, as well as the factors which may cause a Pokémon to be banned (AG/Uber tier) from OU competitive play. In doing so, we will hopefully be able to recognize trends in Pokémon power-scaling and identify weaknesses in game balancing which could potentially be addressed in future generations.



Distribution of Pokémon Types in OU and Above







Methodology

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Call:
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polr(formula = Tier ~ HP + Attack + Defense + Sp..Atk + Sp..Def +
    Speed + Normal + Fire + Water + Electric + Grass + Ice +
    Fighting + Poison + Ground + Flying + Psychic + Bug + Rock +
    Ghost + Dragon + Dark + Steel + Fairy, data = smogon)

Coefficients:
            Value Std. Error t value
HP        0.04436   0.003933 11.2789
Attack    0.02704   0.003422  7.9010
Defense   0.03564   0.003678  9.6889
Sp..Atk   0.03682   0.003538 10.4072
Sp..Def   0.02316   0.003816  6.0680
Speed     0.04523   0.003588 12.6054
Normal    0.60057   0.310673  1.9331
Fire     -0.20579   0.320367 -0.6423
Water     0.45967   0.265246  1.7330
Electric  0.45807   0.348529  1.3143
Grass    -0.16877   0.274554 -0.6147
Ice      -0.38934   0.394869 -0.9860
Fighting  1.87135   0.335771  5.5733
Poison    1.16525   0.300012  3.8840
Ground    1.01491   0.291224  3.4850
Flying    0.66525   0.237961  2.7956
Psychic   0.47004   0.292720  1.6058
Bug       1.57115   0.302486  5.1941
Rock     -0.77990   0.323092 -2.4139
Ghost     1.16304   0.359641  3.2339
Dragon    0.10198   0.337720  0.3020
Dark      1.41955   0.317607  4.4695
Steel     1.46024   0.354207  4.1225
Fairy     2.08832   0.387508  5.3891

Intercepts:
        Value   Std. Error t value
LC|NFE  13.4681  0.6184    21.7786
NFE|PU  14.9075  0.6686    22.2951
PU|PUBL 17.6998  0.7655    23.1225
PUBL|NU 17.8163  0.7683    23.1904
NU|NUBL 18.6841  0.7906    23.6334
NUBL|RU 18.7001  0.7910    23.6413
RU|RUBL 19.6130  0.8168    24.0124
RUBL|UU 19.9768  0.8271    24.1529
UU|UUBL 21.3030  0.8665    24.5850
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```
UUBL|OU 21.7338  0.8781    24.7512
OU|Uber 23.8090  0.9501    25.0589
Uber|AG 29.9885  1.5871    18.8950

Residual Deviance: 1967.881
AIC: 2039.881

       HP    Attack   Defense   Sp..Atk   Sp..Def     Speed    Normal      Fire
1.0453633 1.0274061 1.0362805 1.0375060 1.0234283 1.0462710 1.8231593 0.8140069
    Water  Electric     Grass       Ice  Fighting    Poison    Ground    Flying
1.5835463 1.5810251 0.8446999 0.6775060 6.4970903 3.2067255 2.7591154 1.9449707
  Psychic       Bug      Rock     Ghost    Dragon      Dark     Steel     Fairy
1.6000600 4.8121987 0.4584517 3.1996600 1.1073574 4.1352681 4.3069724 8.0713259



Call:
glm(formula = Banned ~ Total + Mega + Legendary, family = "binomial",
    data = smogon)

Coefficients:
               Estimate Std. Error z value Pr(>|z|)
(Intercept)   -15.564943   2.374760  -6.554 5.59e-11 ***
Total           0.022243   0.004413   5.041 4.64e-07 ***
MegaTRUE       -0.209495   0.745531  -0.281   0.7787
LegendaryTRUE   1.171466   0.654118   1.791   0.0733 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 317.32  on 796  degrees of freedom
Residual deviance: 149.56  on 793  degrees of freedom
AIC: 157.56

Number of Fisher Scoring iterations: 8
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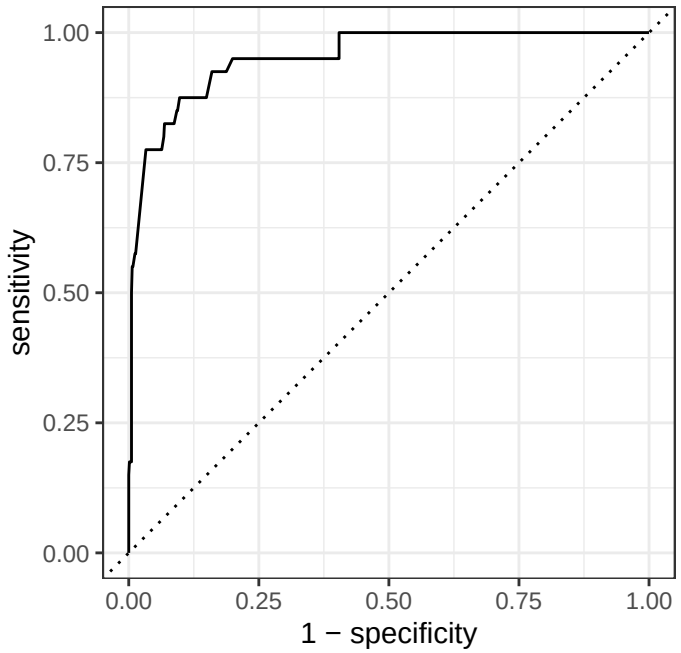


```
# A tibble: 1 x 3
  .metric .estimator .estimate
  <chr>   <chr>          <dbl>
1 roc_auc binary         0.952
```