What Makes a Football Player Run Slowly?

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- **Abbreviated abstract:** The UConn Football program has been trialing the usage of wearable GPS units through the Catapult system to collect data for performance analysis. This project looks at the slowest game that each player had individually (the game in which a player had their lowest maximum velocity over the entire season) and uses regression analysis to judge which aspects of a practice week might cause a player to ‘max out’ a slower speed than they are capable of.

Problem and Data

- For a while, our focus for performance analytics was based solely on data related to PlayerLoad, which is a number that accounts for all movements a player makes in three dimensions (formula below).
- For this project I used seven potential predictor variables: weight class, average PlayerLoad during the practice week, average PlayerLoad over the entire season, the ratio of the two previous variables, maximum velocity in during the practice week, impacts received during the practice week, and high-speed distance.
- The response variable was the lowest maximum velocity a player achieved across all twelve games of the 2019 season.

$$\text{Player load} = \sqrt{\frac{\left(a_{y1} - a_{y-1}\right)^2 + \left(a_{x1} - a_{x-1}\right)^2 + \left(a_{z1} - a_{z-1}\right)^2}{100}}$$

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Methods

- I used regression to determine what aspects of practice during the week were correlated with a slower game speed.
- I created a regression line with all seven of the variables as a source for comparison.
- I tested subsets through forward selection until there were five variables. My goal was to choose a model that had a high coefficient of determination but did not contain all seven variables to make it simpler to work with.
- In addition, I used both ridge regression and lasso approaches for the data, but I found that both approaches had a high error rate and were overly complex.

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Results and Conclusions

- The model I have decided is most accurate and useful includes the maximum velocity from practices leading up to the game (X_1), number of impacts received from practices leading up to the game (X_2), the ratio of the athlete's average Player Load for practices leading up to the game to the athlete's seasonal average Player Load (X_3), and weight class (X_4). This model has a coefficient of determination of 0.62, meaning that 62% of all changes in a player's maximum velocity on game day can be 'explained' by.
- The model is: $\hat{Y} = 6.77 + 0.46X_1 - 0.09X_2 + 3.71X_3 - 0.54X_4$
- Having this model is important because:
  - We can predict the slowest maximum velocity a player could have during a game- anything lower than this benchmark could be a sign of injury
  - We know what factors contribute to a slow game- coaches could change the setup of practice to ensure players are able to reach a high maximum velocity during the game

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