Evolving Monkeys Into Sharks: an Analysis of Daily Fantasy Football Drafting Strategies

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Daily Fantasy Football

Daily Fantasy Football (DFF) is a daily online fantasy sports game where contestants compose teams of NFL players playing that day. Host sites like FanDuel and DraftKings require entry fees to play and contestants win cash prizes, over $500,000. There are two main types of games, Head-to-Head (H2H), where contestants face off one-on-one and Guaranteed Prize Pool (GPP), where contestants fight to place high against a large pool of players. The goal of the game is generally to score more points than your opponent. Points are collected by the performance of the players on your team; a player who performs better scores more points. The contestants are restricted to the players they choose by a salary limit. Each player has a price and the contestant must keep their team under a salary limit.

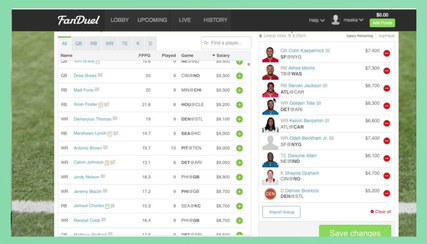


Figure 1. Example FanDuel player selection screen.

Much of the prize money distributed is won by about 1% of contestants, known as sharks, so there is some sort of strategy going in these games.

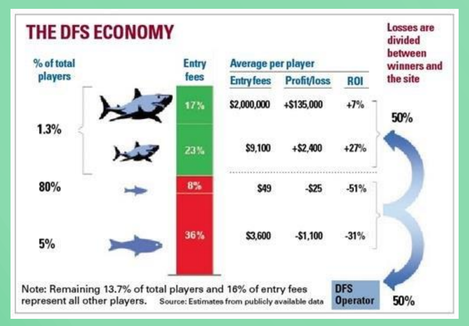


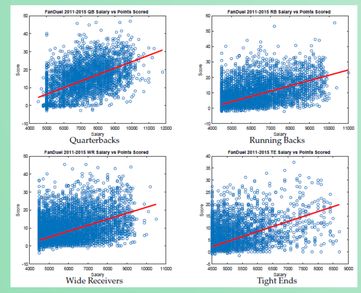
Figure 2. DFS economy.

Project Goals/Questions

- In-depth analysis of the DFF leagues.
- What factors best predict future player performance?
- What position should we allocate most of our salary to?
- How should we, as contestants, compose our team?

Predicting Future Player Performance

- Salary cost
  - Performance increases as salary cost increases at most positions, as expected



Position	R^2 With Opp. Data	R^2 Without Opp. Data	MSE With	MSE Without
QB	.3524	.3508	55.46	55.66
RB	.3743	.3741	31.16	31.16
WR	.3209	.3204	33.31	33.33
TE	.3315	.3309	17.84	17.85
QB, RB, WR, TE	.4115	.4108	32.36	32.39
All	.3763	.3742	32.44	32.47

Figure 3. On left, plots of salary cost against points scored with best fit line, shows us a positive correlation between salary price and points scored. On right, table of error results from performing a multiple linear regression.

- Past performances
  - Using an average of the previous 6-7 weeks of games is the ideal estimate.
- Opponent past performances
  - Regressing past player and opponent performances helps only a little predict future performance. Note the lack of differences of R^2 and MSE in Figure 3.

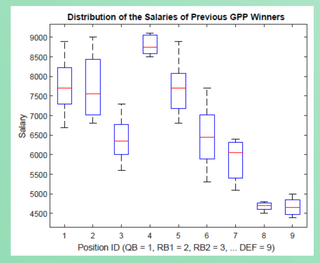


Figure 4. Box plot of salary distributions from 12 past GPP winners.

Models Implemented

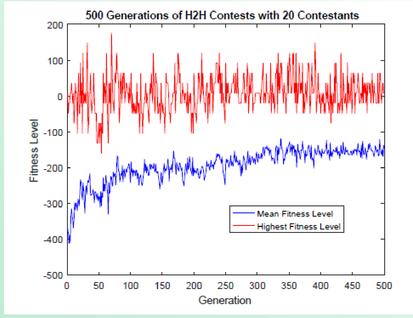
Implemented 6 models. Models play almost every FanDuel week from the 2011-2015 seasons. Models use various statistics and drafting techniques to choose teams.

Early Attempts

- The following are the earlier models implemented, these models performed poorly since they did not spend most of the given salary.
- Value
  - Past performance/Salary.
- Value Over Replacement Player (VORP) and Return Over Investment (ROI)
  - VORP is very similar to just taking the best preforming players.
  - Taking players with the best ROI does not take any elite players.
- Player Swapping
  - Began with "best" replacement players, continued swapping with best available players until over the salary cap.

Genetic Algorithms

Problem solving technique inspired by natural selection. Individuals in a population are evaluated, the more fit individuals survive and breed, the others do not reach the next generation. Customized individuals to have preference of salary at each position. Fitness scores are correspondent to net winnings after playing 5 seasons worth of FanDuel contests.



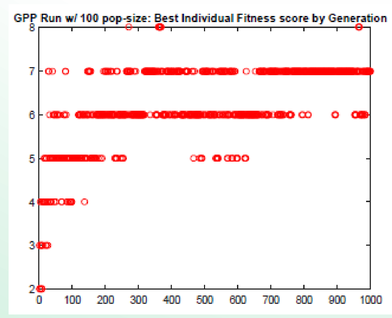
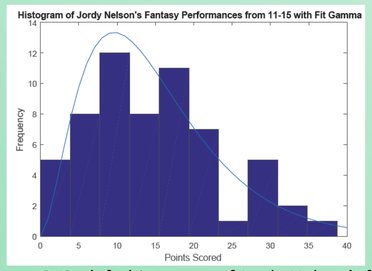


Figure 5. Results from two GA runs. The left, the individuals are playing H2H, the best individuals of each population about break even. The right, the best individuals playing GPP, their fitness scores correspond to the number of times that individual surpassed 175 points in 85 games.

Best Chance

Created the "Winning Space" based on salary ranges and previous points scored of players on past GPP winning teams, see Figure 4. Player performance fits well with a Gamma distribution. This model chooses players based on the best chance they have at surpassing a certain threshold.



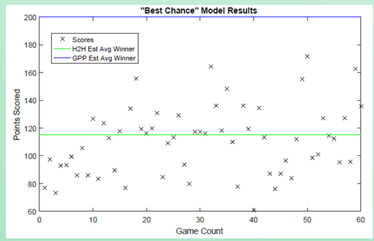


Figure 6. On left, histogram of Jordy Nelson's fantasy performances from the past 5 seasons with gamma distribution pdf. On right, plot of results from Best Chance model. Y-axis is number of points scored at each week, x-axis. The blue line represents the est. number of points to "win big" in a GPP contest, the green line is the est. number of points needed to win a H2H game.

Conclusion

- Lots of randomness goes into predicting future player performance.
- The GA and Best Chance models produced the best teams.
- Past performances and salary price are decent indicators of future performance.
- Spending most of the given salary is wise.
- Splurging on a high priced RB and WR seems to be a common winning theme.