Optimizing
NFL Daily Fantasy Football

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Fantasy Sports

40 million people
(~ twice the population of New York)

=

$7.2 Billion
Industry (~ $1/person on Earth)

	Odds	… more likely than FS
Odds of **winning** $135,000 at fantasy sports (FS)	1 in 136,363	
Odds of dating a **supermodel**	1 in 88,000	
Odds of becoming a **pro athlete**	1 in 22,000	
Odds of being struck by **lightning**	1 in 3,000	45 x

You have a higher chance of making money from playing real football than fantasy football… unless you're a **data scientist**!

Data Preparation

Data Collection

For each game from 2019-2021…

Player Statistics & Salaries
Source: FantasyData.com

Team Injuries
Source: SportsData.io

fantasydata

sportsdataio

Preprocessing

Manipulated raw data to create the following variables for each player…

Player Statistics (4)

Fantasy Points: Accumulated based on performance
Pass Share: Passing attempts ÷ Total offensive plays
Rush Share: Rushing attempts ÷ Total running plays
Target Share: Intended targets ÷ Total passing plays
**computed historical averages (rolling average, last 5 games, last 3 games)*

Opponents (1)

OPR: Opponent Position Rank
**ordered from 1-32, 1 being the hardest opponent*

Team Injuries (4)

QB/TE injured: Whether starting QB/TE is injured
RB/WR injured: Amount of fantasy-relevant RB/WR are injured
**fantasy relevant = above teams' average fantasy points*

Predicting Fantasy Points

Building our Models

For each position…

- Used **2019 & 2020** data
- Ran simple linear regression on all predictors
- Found **best combination** of relevant predictors
- Recursively **added remaining** predictors
- Compared to black-box methods
- **Selected best model** to predict 2021 fantasy points

Results 2021

Real Data:	**DraftsKing Data:**
MSE: 38.59	MSE: 3.46
+/- 6.21 Points	+/- **1.86 Points**

Example: Wide Receiver (WR) Model

FantasyPointsMean_Rolling	0.548^{***}
	(0.055)
TargetShareMean_Last3	22.315^{***}
	(3.590)
OPR	0.042^{**}
	(0.017)
QBInjured	-1.692^{***}
	(0.630)
WRInjured	1.501^{***}
	(0.395)
Constant	-0.250
	(0.408)
Observations	1,868
R^2	0.362
Adjusted R^2	0.361
Residual Std. Error	6.967 (df = 1862)
F Statistic	211.585^{***} (df = 5; 1862)
Note:	*p<0.1; **p<0.05; ***p<0.01

Gurobi Optimization: Finding Best Lineup

Decision Variable:

$Player_i$: 1 if player is chosen, 0 if not

Objective Function:

$$Max\ Z \sum_i Player_i * FantasyPoints_i$$

One football game per week…
accounting for lag data

12 Weeks = 12 Lineups

Found **trends** in 2020 **Perfect Hindsight:**
2021 Model **constraints**

⟹ **Trends**

Rules

1) **Budget ≤ $50 000**
2) **Lineup Composition**

Position	Amount
Quarterback (QB)	1
Running Back (RB)	2
Wide Receiver (WR)	3
Tight End (TE)	1
FLEX (RB/WR/TE)	1
Defense Team (DST)	1

3) **QB & RB -> different team**
4) **Players can't play against DST**
5) **FLEX is WR**

Preliminary Findings

Did our additional constraints help?

Answer:
Yes, slightly

Additional constraints improved our performance **by 1.17** points/week

- **5 weeks they helped**
- 4 weeks they didn't
- 3 weeks indifferent

How well did we perform compared to perfect lineups?

Answer:
Very poorly

Our lineups achieved **157.0 less points per week** than perfect lineups

Reason: Unpredictable nature of fantasy sports

- *All-stars have a bad game*
- *No-names break out*

Are you better off using our predictions or DraftKing's projections?

Answer:
DraftsKing, but it's close

Our lineups achieved **14.8 less points per week** compared to lineups made with DraftKings projections

Now you can compete in Daily Fantasy Football!

Thanks for listening