

Reinforcement Learning of Optimal Strategies in Fantasy Football



CS221 AI project | Young Gun You, Warren MacDonald

What is DFS (Daily Fantasy Sports):

not Depth-first search 😊

- Daily fantasy sports are a subset of fantasy sport games.
- Participants compete against others by building a team of professional athletes from a particular league while remaining under a salary cap.
- Earn points based on the actual performance metrics of players in real-world competitions.

How to Play:

An example for Draftkings (DFS platform)

- Select 9 players
 - 1 x Quarterback
 - 2 x Running back
 - 3 x Wide receiver
 - 1 x Tight end
 - 1 x Flex (RB, WR or TE)
 - 1 x Team defense
- Salary cap of 9 players combined is \$50,000

FLEX	RB L. McCoy NE @ BUF Sun 12PM CST	\$7,600 FPPG 17.2 OPRK 13th
FLEX	WR A. Thielen MIN @ ATL Sun 12PM CST	\$7,500 FPPG 17.9 OPRK 9th
FLEX	TE R. Gronkowski NE @ BUF Sun 12PM CST	\$7,300 FPPG 16.1 OPRK 15th
FLEX	WR D. Hopkins HOU @ TEN Sun 12PM CST	\$7,300 FPPG 21.4 OPRK 25th

Our Objective:

Find a way to win the tournament!

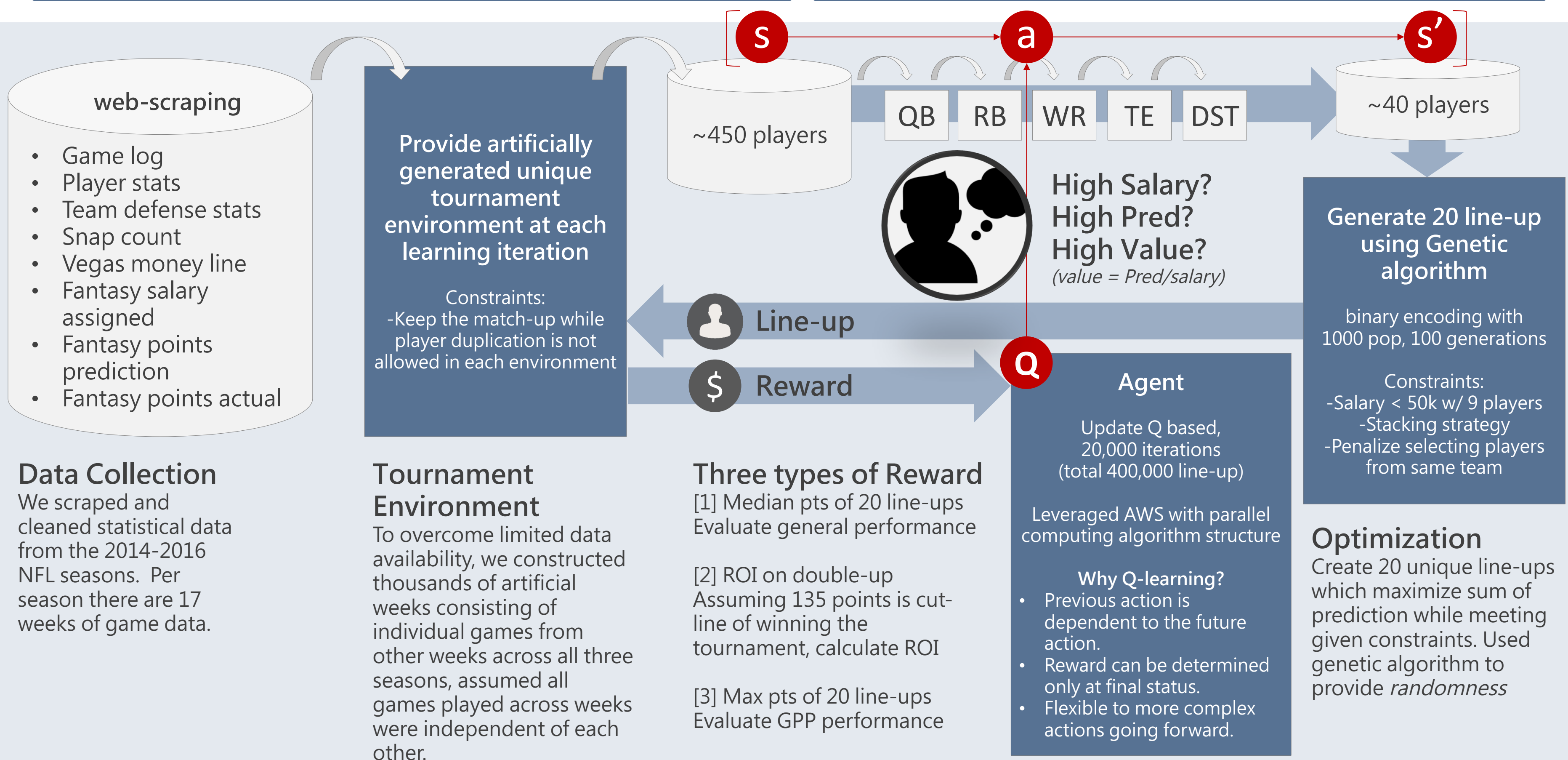
- Median value of the score of tournament participants is 129.
- To win double-up tournament, we need ~135 points.
- The ultimate goal is to find an optimal strategy for building a team of 9 players that maximizes ROI.



Our Challenges:

Easy to play, hard to win...

- Draftkings itself uses machine learning to assign salary, aiming to create equal values across players.
- Individual performance prediction using ML is bad.
 - Avg. error is ~5 pts, while avg. score is ~9 pts.
- Each player only plays 10-15 games per season, so there is limited data available.



Q-Learning & Outcome

What if we played 20,000, what we could've learn from that experience.



- [BEST policy for Double-Up tournament] **122% ROI**
QB(Value)+RB(Value)+WR(Pred)+TE(Value)+DST(Value) $\updownarrow \Delta 35\%p$
- [WORST policy for Double-Up tournament] **87% ROI**
QB(Salary)+RB(Salary)+WR(Value)+TE(Value)+DST(Pred)
- [BEST policy for GPP tournament] **177** highest point average
QB(Pred)+RB(Pred)+WR(Salary)+TE(Pred)+DST(Value) $\updownarrow 15pts$
- [WORST policy for GPP tournament] **162** highest pts.
QB(Salary)+RB(Value)+WR(Value)+TE(Salary)+DST(Salary)

Limitations & Next Steps

How to improve further

- ❖ **Limitation of existing model**
 - Assumed tournament winning cut-off
 - Decisions are too simple
 - Use outsourced player projection
 - Used only 20 line-up
- ❖ **Performance improvement direction**
 - Add more sophisticated actions using stats (player, team, opponents, weather, etc.)
 - Continue improving with weekly game results
 - Generate more line-ups (100+) with player ownership control
 - Improve/adjust fitness function for genetic algorithm
 - Use average (or median) projection from multiple experts

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