UCLA College | Physical Sciences Statistics

Beating the Book:
Using ML to Identify an NBA Betting Edge

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Thesis Overview

PART 1

- ✓ Convert betting lines into win probabilities

PART 2

- ✓ Build model to predict win likelihood for each team in a matchup

PART 3

- ✓ Test performance of my model versus betting odds

Data Sets

GAMBLING DATA

- Betting lines archive for each NBA game from 2007-08 to 2019-20

NBA TEAM GAME LOGS (REGULAR SEASON & PLAYOFFS)

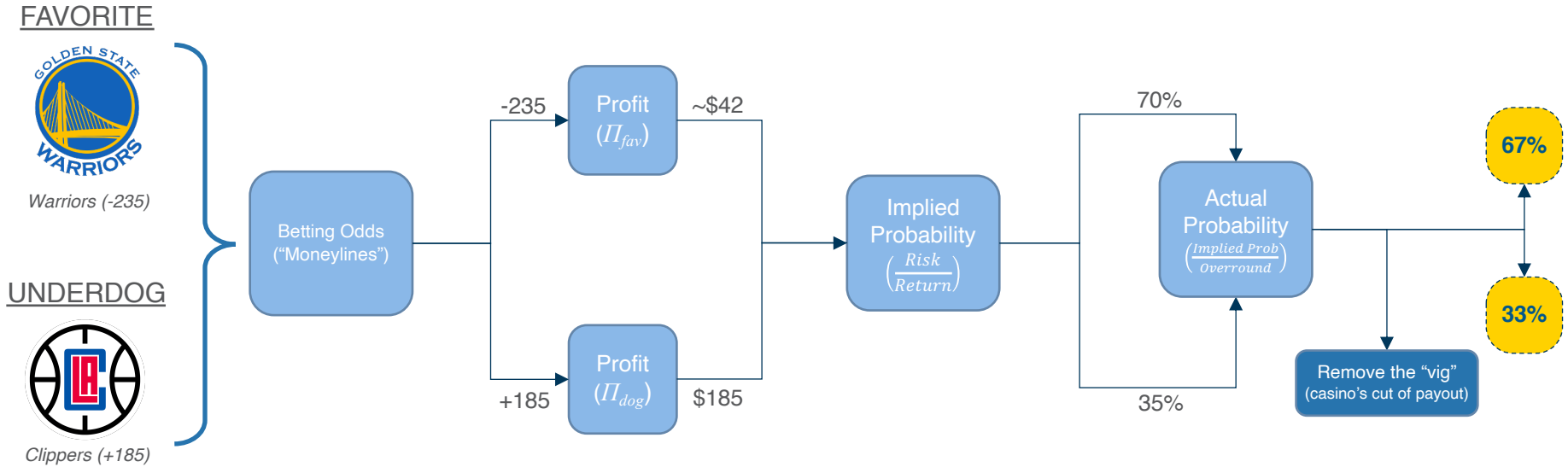
- `nbastatR` package in R with vast API of NBA statistics
- Available team data:
  - Basic statistics (points, rebounds, assists, etc.)
  - Matchup data (home/away, days of rest, game number of the season)
  - Advanced metrics (efficiency ratings, pace of play)

Part 1 – Betting Odds

COMPLETE

MATHEMATICAL DERIVATION FROM BETTING ODDS TO WIN PROBABILITY

(using example of risking $100 wager)



Notes

$$\Pi_{fav} = \frac{100}{-1 * ML} * Risk$$

$$\Pi_{dog} = \frac{ML}{100} * Risk$$

$$Return = Risk + Profit$$

$$Overround = IP_{fav} + IP_{dog}$$

Part 2 – Model Building

IN PROGRESS

GOAL: For each team in a matchup, predict the binary response variable (Win or Loss) along with a confidence level (0-100%) to use in comparison to the betting odds to determine if there's an edge.

AGGREGATION METHODS

- Use aggregation of full season to date to predict current game
- Use a rolling aggregation of last X games to predict current game

POTENTIAL PITFALLS

- Handle postseason and regular season differently?
- Lack of data for early season games. *Solution: use games from end of previous season?*

POTENTIAL MODEL TYPES

- Random Forest (with Boosting?)
- Neural Network
- Ridge or Lasso Regression
- PCA Regression

Part 3 – Model Application

COMPLETE

FIXED WAGER

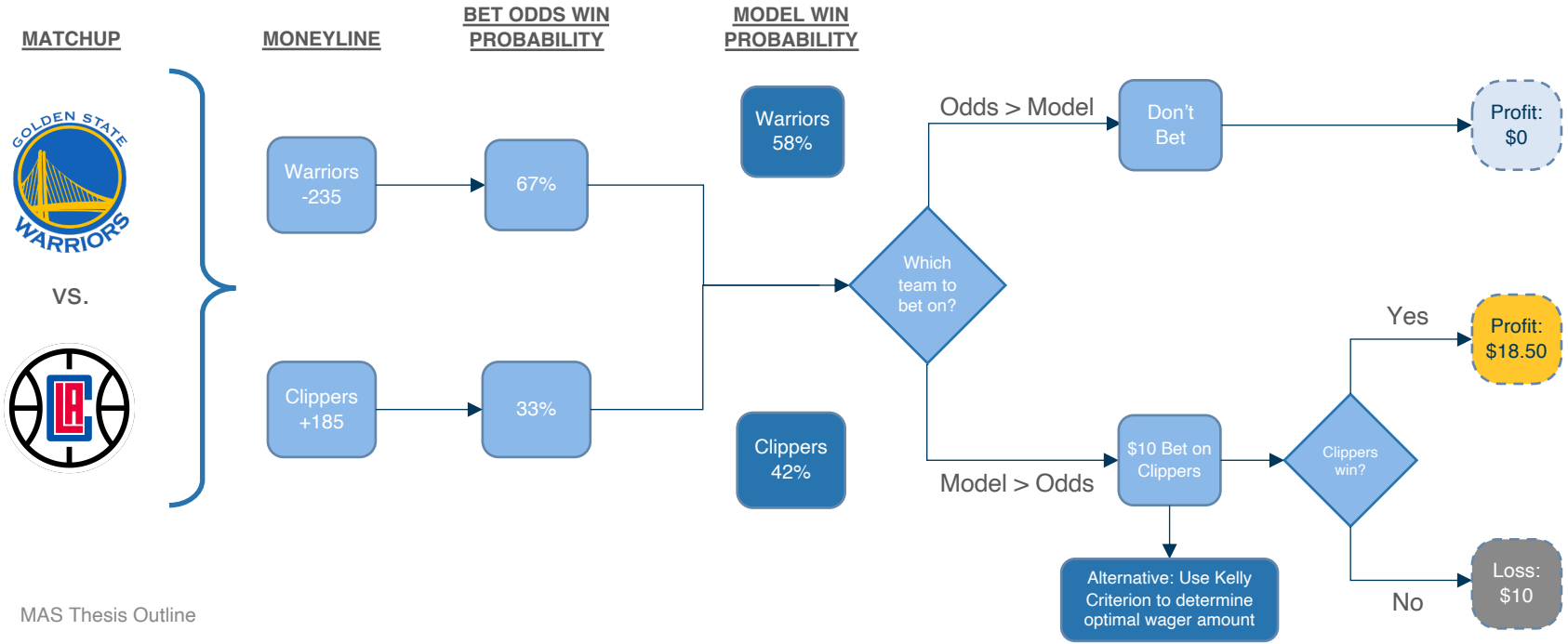
1. Only wager on teams in which model predicts higher win probability than the betting odds.
2. Place fixed bet amount (e.g. $10) on every wager.
3. Accumulate profits and losses from all bets to see the extent that the final amount is above or below starting bankroll of $0.

KELLY CRITERION

1. Only wager on teams in which model predicts higher win probability than the betting odds
2. Implement Kelly Criteria to determine optimal percentage of bankroll to wager based on edge identified from model confidence versus betting odds.
   - Compare results of fractional Kelly: ¼ Kelly, ⅓ Kelly, ½ Kelly, and Full Kelly
3. Accumulate profits and losses from all bets to see if bankroll grows from initial $1000 or trends toward $0.

Logic Flow for Fixed Bet Payout

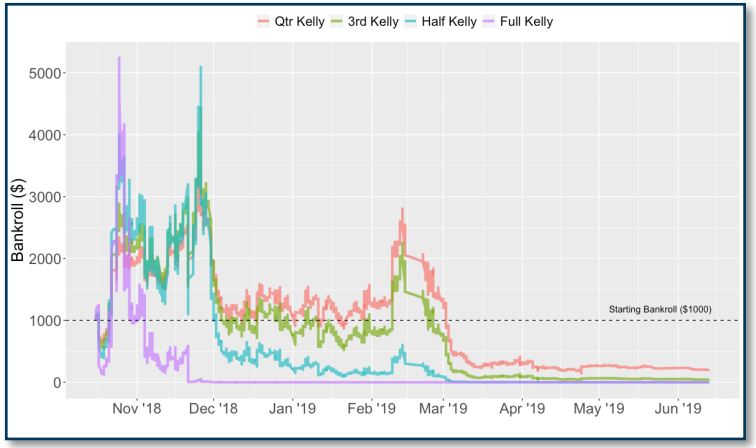
Example application of fixed $10 wager placed for a sample matchup and random model result



Comparison of Betting Strategies

Proof of concept using predictions from a randomized model on 2018-19 NBA season

BANKROLL FROM FIXED $10 WAGER



BANKROLL FROM IMPLEMENTING KELLY CRITERIA

(beginning with $1,000 bankroll)

RANDOM MODEL RESULTS:

Win	Loss	No Bet
667 (25.4%)	674 (25.7%)	1283 (48.9%)

Thank You