SOCCER BETTING SIMULATION: OPTIMIZING LONG-TERM PROFIT

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OVERVIEW

A BETTING SIMULATION ON OVER 8000 GAMES WAS IMPLEMENTED.

THREE STRATEGIES WERE ANALYZED AND COMPARED:

1. ARBITRAGE BETTING
2. POSITIVE EV BETTING
3. ML-BASED BETTING

THE GOAL IS TO ASSESS GENERAL PROFITABILITY AND THE BEST METHOD FOR LONG-TERM PROFIT

RAW DATA

DATA FOR 8264 LEAGUE MATCHES IN THE TOP 5 EUROPEAN FOOTBALL LEAGUES IN THE 2019-2020, 2020-2021, AND 2021-2022 SEASONS:

1. FIXTURE DATA (SPORTS REFERENCE)
   - DATE, RESULT, HOME TEAM, AWAY TEAM, ATTENDANCE, VENUE, LEAGUE, REFEREE, GOALS HOME, GOALS AWAY
2. ODDS DATA (FOOTBALL-DATA.CO.UK)
   - MARKET MAXIMUM, MARKET AVERAGE, AND 6 BOOKMAKER ODDS (HOME DRAW, AWAY)

PROCESSED DATA

date	result	home	away	b365h	b365d	b365a	max_h	max_d	max_a	avg_h	avg_d	avg_a
2019-08-09	A	Monaco	Lyon	3.00	3.3	2.37	3.0	3.60	2.52	2.89	3.40	2.43
2019-08-10	A	West Ham	Manchester City	12.00	6.5	1.22	13.0	6.75	1.29	11.84	6.28	1.25
2019-08-10	H	Burnley	Southampton	2.62	3.2	2.75	2.8	3.33	2.85	2.68	3.22	2.78

1) ARBITRAGE BETTING: FORMULAS

SPOT ARBITRAGE OPPORTUNITY:

$$1/odds_h + 1/odds_d + 1/odds_a < 1$$

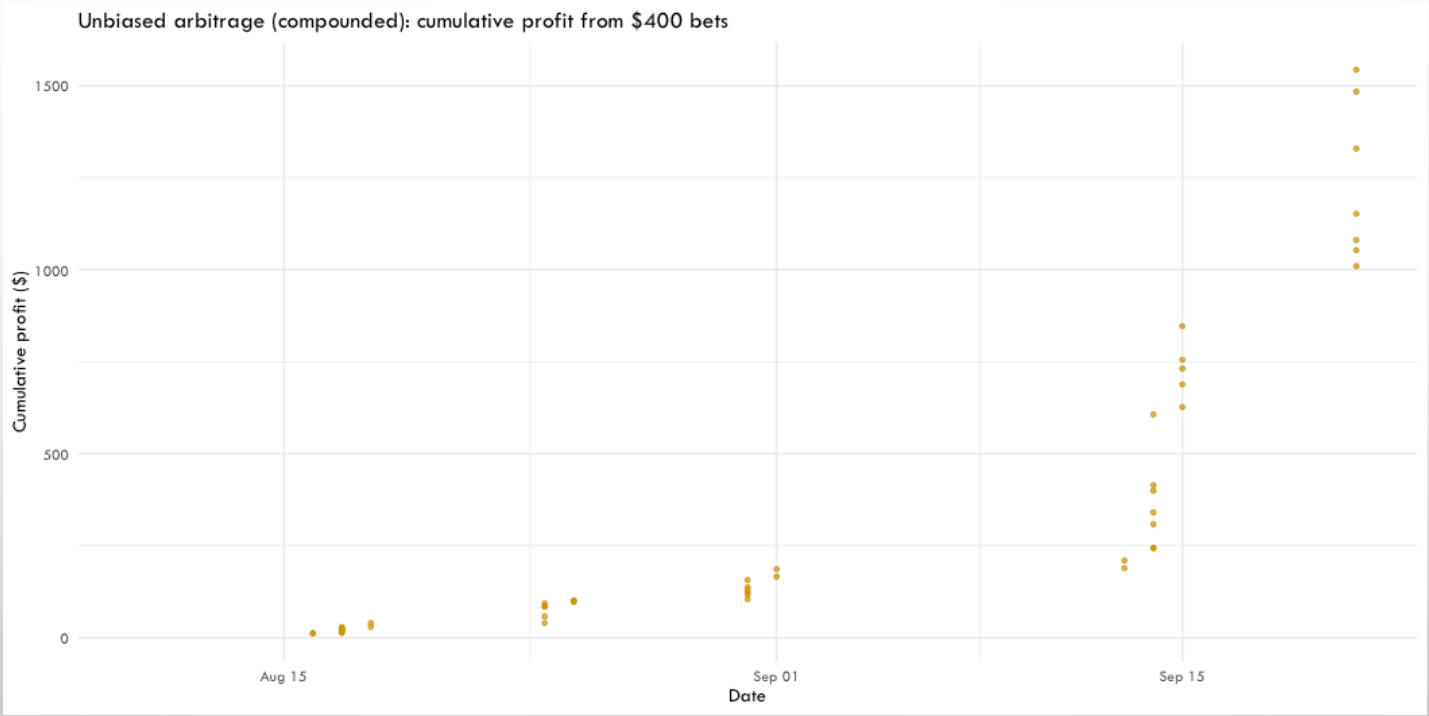
REQUIRED WAGER AMOUNT TO ENSURE RISK FREE BET:

$$wager_h = wager_t/\left(1 + (odds_h/odds_d) + (odds_h/odds_a)\right)$$
$$wager_d = wager_t/\left(1 + (odds_d/odds_h) + (odds_d/odds_a)\right)$$
$$wager_a = wager_t/\left(1 + (odds_a/odds_h) + (odds_a/odds_d)\right)$$

1) ARBITRAGE BETTING: CALCULATION

date	wager_h	wager_d	wager_a	wager_total	profit	cum_profit
2019-08-10	NA	NA	NA	NA	NA	NA
2019-08-16	329.44	49.62	23.53	402.59	9.21	11.81
2019-08-16	267.59	89.20	57.61	414.40	0.37	12.18
2019-08-17	341.71	59.74	25.13	426.57	0.56	12.74
2019-08-17	83.39	100.45	255.48	439.31	2.66	15.40

1) ARBITRAGE BETTING: SIMULATION



1) ARBITRAGE BETTING: EVALUATION

- ADVANTAGE: GUARANTEED AND COMPOUNDED PROFIT
- DISADVANTAGE: NOT ALLOWED FOR LONG (USUALLY GET BANNED)

2) POSITIVE EV BETTING: FORMULAS

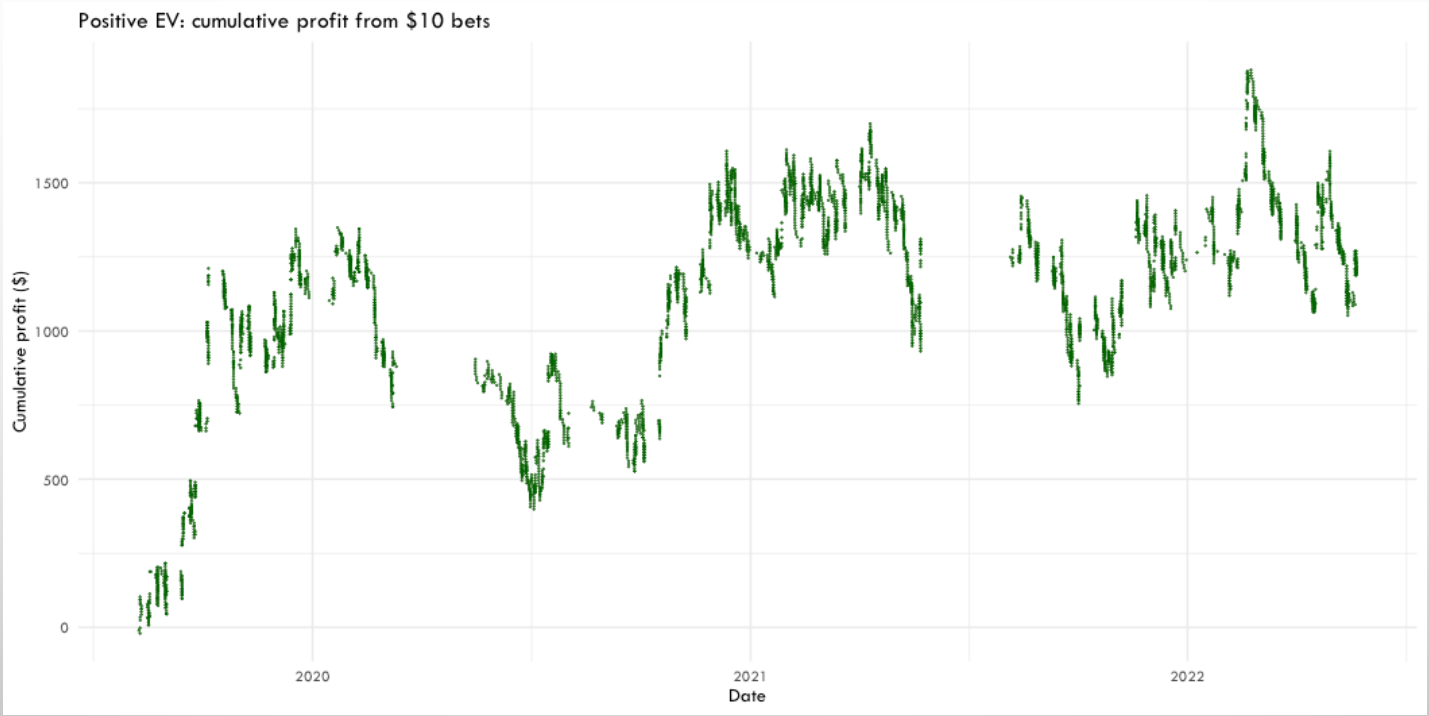
$$EV_h = 10(odds_h - 1)p_h + (-10)(1 - p_h)$$
$$EV_d = 10(odds_d - 1)p_d + (-10)(1 - p_d)$$
$$EV_a = 10(odds_a - 1)p_a + (-10)(1 - p_a)$$

(p WAS CALCULATED USING ITS CORRESPONDING $odds_{(avg)}$, DETAILED CALCULATION IN SOURCE CODE)

2) POSITIVE EV BETTING: CALCULATION

date	ev_h	ev_d	ev_a	bet	wager	result	profit	cum_profit
2019-08-09	-0.13	0.07	-0.14	D	10	A	-10	-10
2019-08-10	0.52	0.30	-0.11	H	10	A	-10	-20
2019-08-10	0.01	-0.09	-0.17	H	10	H	18	-2
2019-08-10	-0.12	-0.16	0.35	A	10	A	36	34
2019-08-10	-0.16	-0.02	0.08	A	10	D	-10	24

2) POSITIVE EV BETTING: SIMULATION



2) POSITIVE EV BETTING: EVALUATION

- ADVANTAGE: LONG-RUN PROFIT
- DISADVANTAGE: SHORT-RUN FLUCTUATIONS REQUIRE MANY BETS AND MAKE BIG BETS RISKY

3) MACHINE LEARNING BETTING: TRAINING

RESAMPLING

- 6612 GAMES FOR TRAINING (80% OF TOTAL)
- V-FOLD CROSS VALIDATION WITH 5 FOLDS AND 5 REPEATS
- PRECISION (TRUE POSITIVES/TOTAL PREDICTED POSITIVES) AS PERFORMANCE MEASURE

3) MACHINE LEARNING BETTING: TRAINING

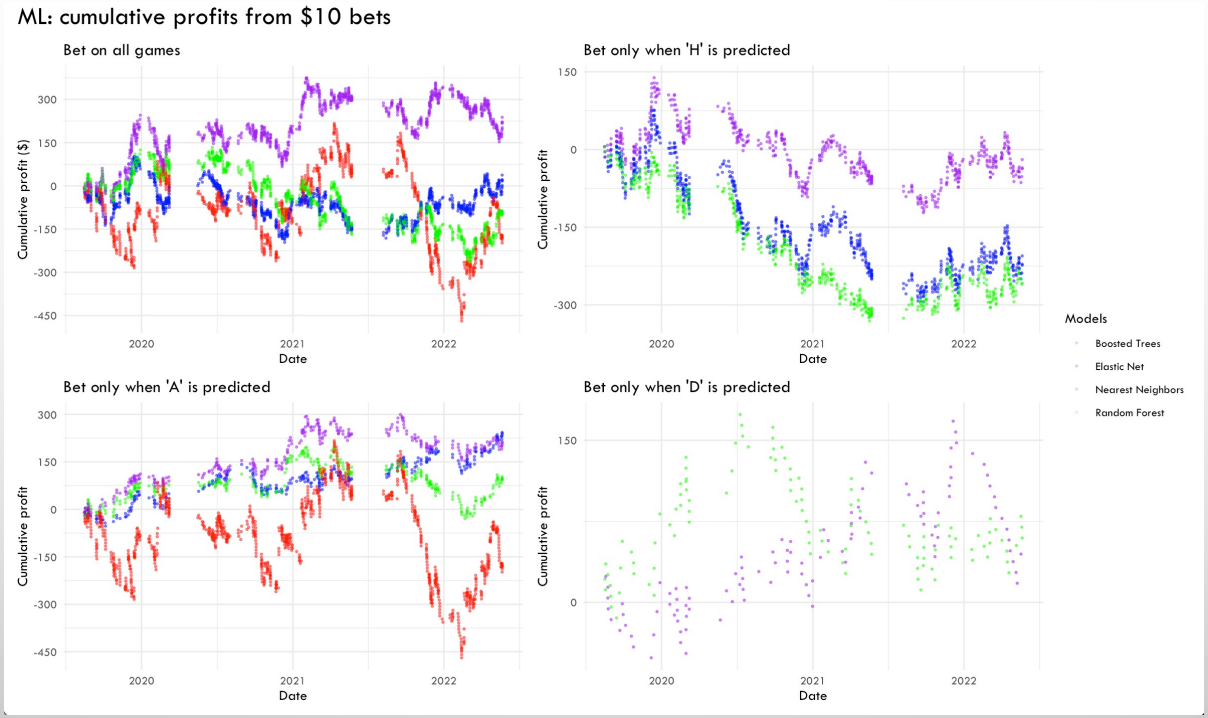
MODELS

- RANDOM FOREST
- BOOSTED TREES
- ELASTIC NET
- NEAREST NEIGHBORS

PREDICTORS

PCA ON ALL 6 BOOKMAKERS' ODDS

3) MACHINE LEARNING BETTING: SIMULATION



3) MACHINE LEARNING BETTING: EVALUATION

- ADVANTAGE: HIGH PROFITABILITY ACHIEVED WITH ONLY BETTING WHEN DRAW OR AWAY IS PREDICTED
- DISADVANTAGE: LIMITED GAMES TO BET PER SEASON

FINAL COMPARISON

*PROFITS OF MACHINE LEARNING METHODS ARE MULTIPLIED BY 8264/1010 SINCE ONLY 1010 GAMES WERE AVAILABLE (TESTING DATA WAS 20% OF THE TOTAL AND NOT ALL GAMES HAD MARKET MAX/AVG ODDS)

*PROFIT OF THE POSITIVE EV METHOD IS MULTIPLIED BY 8264/4963 SINCE ONLY 4963 GAMES HAD MARKET MAX/AVG ODDS.

Method	Estimated profit per season ($)*	Estimated Profit ($)*	Profit ($)	Number of bets
Random Forest (A&D)	791.7621	2375.2863	290.3	436
Nearest Neighbors (A&D)	702.3036	2106.9109	257.5	431
Positive EV	661.4419	1984.3258	1191.7	4565
Nearest Neighbors	649.3922	1948.1766	238.1	1010
Elastic Net	102.5500	307.6499	37.6	1010
Random Forest	59.7299	179.1897	21.9	1010
Boosted Trees	-540.0238	-1620.0713	-198.0	1010

THANK YOU!

- ACCESS SOURCE CODE ON MY GITHUB
- EMAIL ME WITH QUESTIONS AND COMMENTS