



# Horse Betting Analysis

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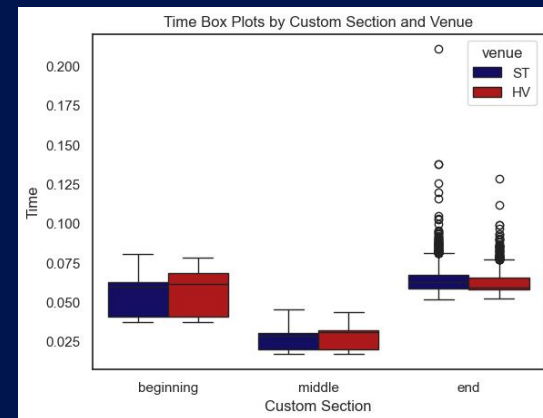
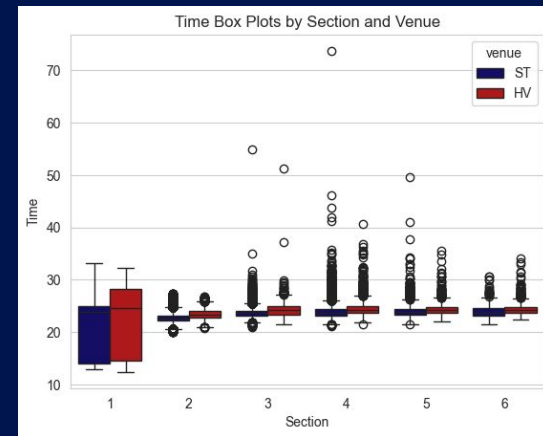
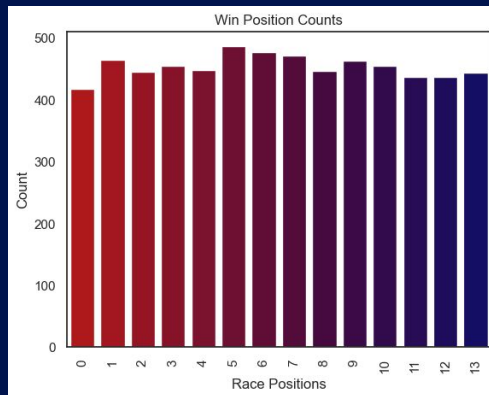
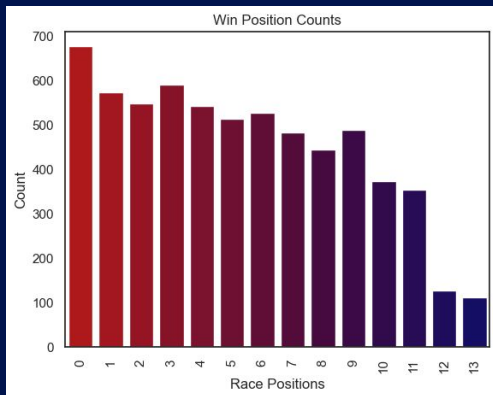
Spring 2024 WAF Application  
Kyle Sullivan

# Exploratory Data Analysis

6,342 Unique Races | 79,421 Horse Runs

## Overview & Challenges

- **Feature Engineering**
  - Metric rolling averages (window: 3 races)
  - Standardizing section times by distance
  - Binary indicator variables categorical values
  - Cyclical month transformation (sine/cosine)
- **Imbalanced Data**
  - Shuffled horse positions



# Predicting Horse Times

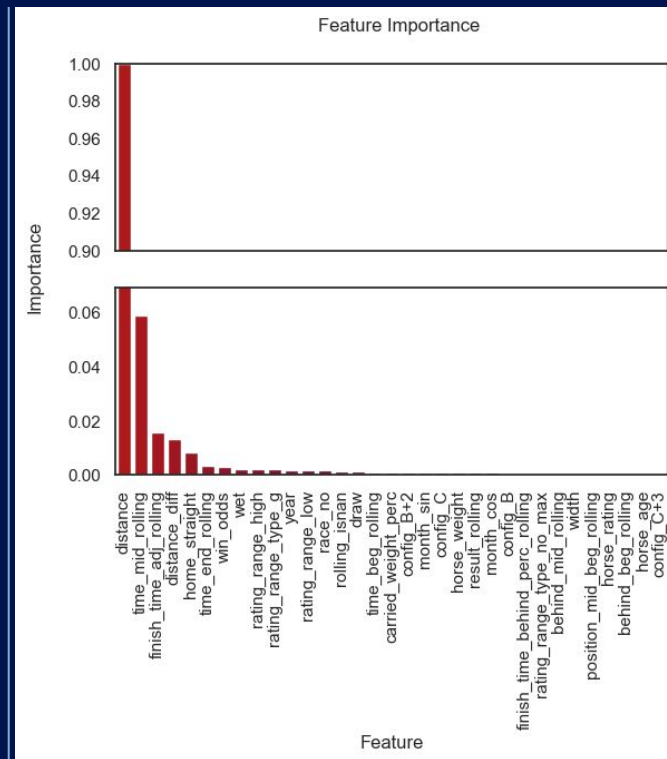
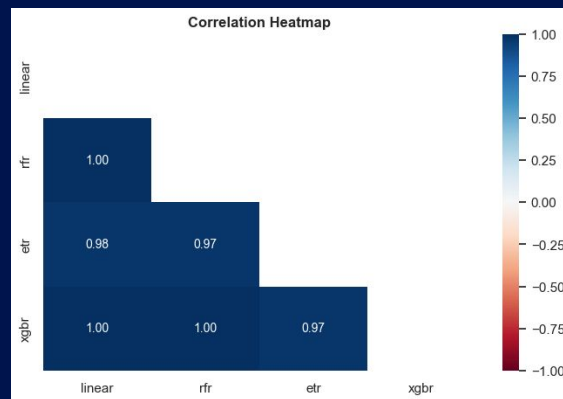
## Roadmap:

- **Baseline (BL): Predict Average Time by Distance**
- **Feature Selection / Engineering**
- **Hyperparameter Tuning**
- **Ensemble Model**

Model	BL	Ridge Reg.	Rand. Forest	Extra Trees	XG Boost	MLPR	All
MSE	1.4924	1.1375	0.9822	1.0027	0.9872	1.1008	0.9605
MAPE	0.0102	0.0088	0.0078	0.0079	0.0077	0.0084	0.0077

## Top Features:

- **Distance**
- **Middle Section Time (R)**
- **Finish Time / Dist. (R)**
- **Distance Difference**
- **Home Straight Length**



# Predicting Race Winners

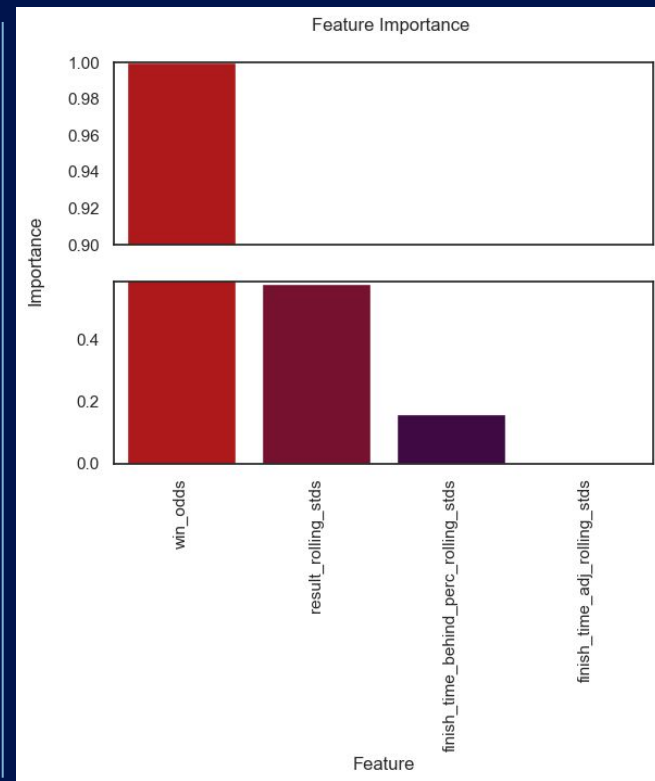
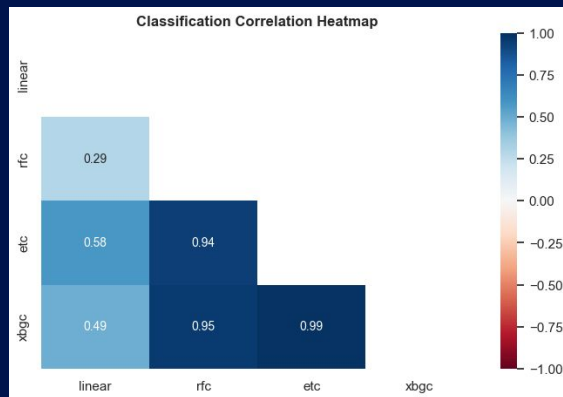
## Roadmap:

- **Baseline (BL): Predict Winner by Best Odds**
- **Feature Selection / Engineering**
- **Hyperparameter Tuning**
- **Ensemble Model**

Model	BL	LR	Rand. Forest	Extra Trees	XG Boost	MLPC	All
ACC	0.3006	0.2199	0.2558	0.2298	0.2493	0.1606	0.2544
CEL	11069	11655	11916	12334	11438	13286	11965

## Top Features:

- **Win Odds**
- **Placement Results (R)**
- **Finish Time / Leader Time (R)**
- **Finish Time / Dist. (R)**



# Insights and Future Improvements

## Takeaways:

- Dominant Features in both Models
  - Distance and Win Odds
  - Make it difficult to assess the usefulness of other variables
- Next Steps
  - Bradley-Terry Model
    - Split each race into a 1 vs. 1 races between all horse pairings
    - Use head-to-head outcomes to assign scores/ratings to each horse
  - Deep Learning
    - Utilize time series nature to predict finish times & winners
    - LSTM
    - GRU
- Best Advice
  - The gambling odds are difficult to beat
    - Sports Books have a huge financial incentive to get this right