Modeling College Football Betting as an MDP

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November 9, 2024

1 Introduction

1.1 Background

Sports betting has surged in popularity in recent years, with online platforms making it accessible to the public. This section introduces betting mechanics, including Moneyline bets and the spread.

1.2 Objective

The goal of this project is to model college football betting as an MDP to predict profitable bets each week. Using Bellman's equation with discounted rewards, we aim to maximize returns by dynamically updating weekly predictions based on recent team performance.

2 Problem Definition

2.1 Formal Problem Statement

This project addresses which teams to bet on each week to maximize returns, based on historical performance and odds data.

2.2 Problem Components

- **States:** Weekly game data, including team odds and spread.
- **Actions:** Bet for or against a team.
- **Rewards:** Actual outcomes vs. expected odds-based results.
- **Sequential Influence:** Recent weeks have a linearly decaying influence on each week's decision.

3 Methodology

3.1 Data Collection

Data from collegefootballdata.com, including Moneyline odds, spreads, and outcomes, will be used. Key variables include weekly odds, game results, and point spreads.

3.2 Problem Formulation as an MDP

We define the problem as an MDP where each week is a state, and each betting decision (for or against) represents an action. We use the Bellman equation with linearly decaying past rewards to adjust weekly probabilities.

3.3 Alternative Approaches

We considered a Multi-Armed Bandit approach; however, MDP is chosen to account for the sequential influence of past games.

4 Solution Strategy

4.1 Bellman Equation Application

The Bellman equation applies here by incorporating each week's expected reward adjusted by discounted past outcomes. Rewards from previous weeks decrease linearly in influence.

4.2 Model Training and Evaluation

We will employ reinforcement learning techniques to train the model, using accuracy and profitability as evaluation metrics.

5 Results and Analysis

5.1 Experimental Setup

The model will be tested on historical data, with sample sizes and configurations specified.

5.2 Performance Metrics

Metrics include the accuracy of betting predictions, cumulative rewards, and actual profit achieved by the model.

5.3 Results

Key findings, with figures and tables as necessary, showing model performance and profitability.

6 Discussion

6.1 Insights and Interpretations

Analysis of model performance, including successful patterns and any identified trends in betting outcomes.

6.2 Limitations and Future Work

Discussion on limitations such as data gaps or model assumptions, along with potential future improvements.