CS 229 Final Project Proposal

Due: Friday, April 21 @ 11:59 PM PST

I. Key Information.

- *Title*: If (A)I were a betting man: Profitable Sports Betting with Deep Reinforcement Learning
- *Category*: Theory & Reinforcement Learning
- *Team member(s)*: Anthony Weng
- *SUNet ID(s)*: 06260489

II. Project Elements.

A. *Motivation*:

Sports betting has long been a popular pastime, increasing spectator engagement in a given sporting event by creating a personal financial investment in its outcome. For casual bettors, the minor windfall which accompanies a small bet gone well is appreciated but rarely looked to as a source of reliable income. However, dedicated odds analysts attempt to routinely beat the money lines, employing expert prediction models, arbitrage strategies, etc. in their quest to do so (Kaunitz et al., 2017).

The complexity of and sport-specific knowledge required to employ such strategies remain barriers to the casual bettor looking to become more serious. However, one source of information is available to all: the money line itself. The value of and movements in the money line provide an imperfect signal of the wisdom of the crowd. In this application-type project, I'll evaluate whether a machine learning system can use these signals to develop a profitable long-term betting policy—both to democratize sophisticated sports betting and to stick it to the [house].

B. *Method:*

The core technique I will apply for this project is deep reinforcement learning (DRL). Using some d-dimensional vector of past money lines and the current money line as features, I will train a neural network to represent the betting policy, with rewards likely being computed as a function of the agent action (bet with/against the money line), event outcome (i.e., does the bet-upon team win/lose) and a bet value of a fixed amount.

I will also employ logistic regression to develop a linear baseline to compare the AI agent against. Using the same features provided to the DRL architecture, the logistic regression will be fit to target values of +1/-1 representing betting with or against a given money line as determined by whichever bet would be profitable given the event outcome.

C. *Intended experiments:*

The policy represented by the trained DRL model will be evaluated on some held-out test set, and metrics including percentage profitable bets and overall profitability will be computed. These metrics will also be computed for the logistic regression baseline for comparison. Additional baselines may be developed and similarly evaluated. Potential baselines include randomly for/against betting and always betting the odds-on favorite.

D. *Relevant background materials:*

Example of prior research: Kaunitz, L., Zhong, S., & Kreiner, J. (2017). Beating the bookies with their own numbers-and how the online sports betting market is rigged. *arXiv preprint arXiv:1710.02824*.

Associated dataset: [Beat The Bookie: Odds Series Football Dataset | Kaggle](#)

III. Disclosure.

In a past course (i.e., CS 238: Decision Making under Uncertainty), I have employed DRL as a core component of the final project. In said project, I used DRL to train an AI agent to play a custom-built *Street Fighter*-type game. Both my enjoyment with using DRL methodologies and the fact that my trained agent achieved (very) limited success motivated my exploration of another DRL-centric topic for the CS 229 final project. I've included this disclosure here to ensure that there will not be any issues with me doing so given the conceptual overlap of these projects—please let me know if there are, and how I can proceed if so. Thank you!