Goals

We want to maximize the long term monetary gain to produce a stable source of return.

Deliverables

Produce a simulation on never before tested data and produce a graph of the returns long term (multiple years). It should produce a strong return (minimum 5% target 10%, with a stability comparable to the stock market).

Formalization

g_t is the money in the pot, g_0 is the initial investment, r_t is the percent return between g_t and g_{t+1} such that $g_{t+1} = r_t g_t$.

$$\max \lim_{t \to \infty} g_t$$

We can then define the amount we invest in each team, where we have teams A and B. An investment in team A would be represented as A and a investment in no team is $\emptyset$. Thus $A_t + B_t + \emptyset_t = g_t$.

Let's assume we have a model that provides us with both a probability of team A winning, $P[W_t = A]$, and its confidence on that probability, ϵ_t.

Below is the Hoeffding bound

$$P[|v - \mu| > \epsilon] \leq 2e^{-2\epsilon^2 N}$$

There is also a given gambling odds O_A and O_B such that $O_A = 1 - O_B$.

$$g_{t+1} = \emptyset_t +$$

Implementation

Architecture

1. **Probability estimation**: Generates $P[W_t = A]$ and ϵ. Should create a game environment similar to a sport where I can measure and re-run to manually calculate $P[W_t = A]$ and calculate the correctness of ϵ to test is the model is constructed properly prior to using real data

2. **Gambler model**: Uses $P[W_t = A]$ and ϵ generated by the probability estimation model to find the optimal gambling strategy. Note that this model should be re-trained for each sport that is played as the sampling distribution will vary from sport to sport

Milestones

1. Train gambler reinforcment model with sim that gives $P[W_t = A]$ and ϵ see if we can profit maximize in this environment, this way we don't need any data yet its just a game agnostic model that can be applied in any gambling situation

2. Create a sports environment with a similar setup to baseball and provides a similar data

3. Write and test model until epsilon is correct within a certain bound to be defined

4. Create data API for use in training the probability estimation model

5. Train the model

6. Use end to end and test

7. Write front end and ship

Concerns to consider

There will be a tradeoff between achieving a good return and losing a large amount of pot. How accurate are betting odds int terms of expected value.