

Computer Science 4963/6963 (Internet Economics): Homework 3

Due: April 16, 2012

1 Overview

You will be working in teams of two or three to write a trading strategy for prediction markets that trades against the logarithmic market scoring rule (LMSR) market maker described in class. Your trading algorithm is the only player in the market, and it has access to noisy information about the true probability that an event will occur. The information you receive is in the form of biased coin tosses from the true distribution; one thing to be aware of is that the true distribution can change over time, in the manner described below.

The deliverable for this project is one concise project report from each team. Specifics of what we expect are described below.

2 Underlying Model

There are up to R rounds $1 \dots R$, each representing a distinct time period. There is an underlying true probability that the event will occur, which is unknown to everyone, but can change over time. At round i , let p_i be the true probability of the event occurring. During this round i , your trader will be told the outcome of one Bernoulli trial (biased coin toss) with success probability p_i . The trader can then buy and sell the security (there are no inventory or cash restrictions – your trader can take arbitrary positive and negative positions).

2.1 Time evolution of p_i

The true probability is a jump process. p_0 is chosen uniformly at random between 0 and 1. At the beginning of a round, p_i is calculated as follows: with probability $1/R$, $p_i \sim N(p_{i-1}, \sigma_{\text{jump}})$, and $p_i = p_{i-1}$ otherwise. That is, at any time, with probability $1/R$ the true probability jumps, and when it does jump, the new true value is drawn at random from a normal distribution centered on the present true value. If $p_i \leq 0$ or $p_i \geq 1$, the security liquidates prematurely at 0 or 100 respectively. Otherwise, the value of the security is $100p_R$ after round R .

2.2 Parameters

For this assignment, $R = 100$ and $\sigma_{\text{jump}} = 0.2$.

3 Software Framework

We have provided a software framework for you in Python. Please look at it carefully and read the `README` file. The framework handles many tasks, including the generation of data for your bot to use in making trading decisions, handling the market making side of things, and collecting and printing aggregate data from single / multiple simulations.

4 Team Composition

You may work in teams of two or three. Please keep in mind that it will be easiest if one of your team members is conversant in Python. Each team needs to hand in only one report (described below).

5 What To Do

First, make sure you understand the assignment, and ask questions if you don't, or even if you just want to clarify! Second, start reading and understanding the code, and also start thinking about what kind of trading strategy you want to use

6 What To Turn In

I will look specifically for answers to the following questions in your writeup. It is best to address them explicitly. You may add other information that you feel is relevant as well.

1. How does your trader estimate p_i at time i ? What algorithm do you use to try and account for the probability of jumps?
2. At which periods does your trader choose to trade? How did you decide this?
3. How does your trader decide what quantities to trade?
4. Report the mean profit and standard deviation of profits your trader achieves over at least 1000 simulation runs.
5. Graphically depict the evolution of prices in one simulation run which you consider typical for your trader.

You will be graded primarily on the quality of your writeup, but also in terms of performance. In particular, strategies that make good average profit without having very high variance of profits will be considered the best.

7 Final Note

The final project will build on this work. You will have to compete with other traders who may also be trading with the market maker – we will give you code for several agents we have designed for you to compete against. Then you'll turn in your code and we'll have a big contest between all the trading agents designed by the class! So keep this future extension in mind while working on this project.