

CARLETON UNIVERSITY
SCHOOL OF COMPUTER SCIENCE
WINTER 2023

COMP 5005

Final Project

Due Apr. 14, 2023

One of the most quoted applications of Learning Automata (LA) is in Game Playing. This project involves the implementation of a system which plays a particular game using LA.

Consider the following extract from Narendra and Thathachar's book:

“As an illustration of the automata game setting, consider the following simple voting game, known as a Goore game (Tsetlin, 1973). Imagine a large room containing N cubicles and a raised platform. One person (voter) sits in each cubicle and a referee stands on the platform. The referee conducts a series of voting rounds as follows. On each round the voters vote *Yes* or *No* (the issue is unimportant) simultaneously and independently (they do not see each other) and the referee counts the fraction of *Yes* votes. The referee has a unimodal performance criterion $g(\theta)$ $[0,1]$, which is optimized when the fraction of *Yes* votes is exactly θ^* . The current voting round ends with the referee awarding a dollar with probability $g(\theta)$ and assessing a dollar with probability $1 - g(\theta)$ to every voter independently. On the basis of their individual gains and losses, the voters then decide, again independently, how to cast their votes on the next round. The intriguing feature of this game is that if each voter updates according to either a Tsetlin Automaton with large memory or an absolutely expedient algorithm, then the entire group will asymptotically optimize the referee's performance criterion.”

The project will involve having LA play the Goore game. You must:

- (i) Verify the above claim for various schemes including the Tsetlin and the L_{RI} scheme.
- (ii) Suggest how the players should play when the function $g(\theta)$ is bi-modal, and the users know that it bi-modal.
- (iii) Suggest a simple scheme by which two learning automata can be compared in terms of their accuracy and rates of convergence.
- (iv) Suggest at least one discretized and one estimator scheme to play the game.

Your project will have to include a well-documented write-up, the implementation details of your prototype, and finally, the simulation results which you have obtained.

Can you suggest a potential application of this problem????

Remember that any marked “superior” performance of a new scheme represents a new potential result which the scientific world would be interested in. In your report, try to also include some reasons why the various techniques that you tried worked or did not work as you would have liked.