CITS 3001 - 2022

Project: A game on operations in the information environment

Due Date: 13th October

Implementation: Java or Python

Game Scenario

There are four teams involved: Red, Blue, Green and Grey.

The scenario has been deliberately designed to represent the uneven playing field of the contested environment between the various teams. The scenario highlights the vulnerabilities of blue team in the contested information environment. The concept of blue and red teams is prevalent in cybersecurity related serious games or wargames. If you wish to get some background knowledge about the functioning of teams, you can read this article: https://csrc.nist.gov/glossary/term/red_team_blue_team_approach. However, this game is not related to cyber security, rather we are modelling the information environment in a country.

Red and **Blue** teams are the major geopolitical players in this fictitious country.

Red team is seeking geopolitical influence over Blue team. Of particular interest to Red team is influence over Green population and the Government. Blue is seeking to resist the Red teams growing influence in the country, and promote democratic government in the **Green** country.

A key challenge faced by the **Blue team**, that will become apparent in the exercise, is that their democratic values are leveraged against them. They are vulnerable to some forms of manipulation, yet their rules-of-engagement do not allow them to respond in equal measure: there are key limitations in the ways in which they respond and engage in this unique battlespace. The Blue team is bound by legal and ethical restraints such as free media, freedom of expression, freedom of speech.

The **Green team** lacks a diverse media sector, it is confused and there is a wide range of foreign news broadcasting agencies Green's population has subscribed to. The Green population suffers from poor internet literacy, and the internet literacy can be modelled via pareto distribution. The government lacks resources to launch a decisive response to foreign influence operations and a lack of capability to discover, track and disrupt foreign influence activity.

The **Red team**, an authoritarian state actor, has a range of instruments, tactics and techniques in its arsenal to run influence operations. The Green government can block websites and social media platforms and censor news coverage to its domestic population whilst maintaining the capability to run sophisticated foreign influence operations through social media.

The **Grey team** constitutes foreign actors and their loyalties are not known.

Election day is approaching and the Red team wants to keep people from voting.

Population Model:

An underlying network model that define the probability of nodes interacting with each other. Majority of the nodes, over 90%, will belong to green team and they depict the population of the country. A small percentage of nodes will be red, blue and grey. At the beginning grey nodes are not part of the network.

Each green node/agent has an opinion and an uncertainty associated. In every simulation round nodes will interact with each other and affect each others' opinions. The more uncertain an agent is, the more likely their opinion would change. The probability of interaction is not uniform across all nodes. Some nodes (for instance those in a household), may have a higher probability to interact.

How teams are going to take turns:

Teams are going to take turns one by one.

1. Red Team: You need to create function where red team (only 1 agent) is able to interact with all members of the green team. The agent affects the opinions and uncertainty of the green team during the interaction. The catch is that you need to select from **5 levels of potent messaging**. If the red team decides to disseminate a potent message, during the interaction round, the uncertainty variable of the red team will assume a high value. A highly potent message may result in losing followers i.e., as compared to the last round fewer green team members will be able to interact with the red team agent. However, a potent message may decrease the uncertainity of opinion among people who are already under the influence of the red team (meaning they are skeptical about casting a vote). You need to come up with intelligent equations so that red team improves the certainity of opinion in green agents, but at the same time does not lose too many green agents. Think of it as a media channel trying to sell their narrative to people. However, if they may big, claim, lie too much, they might lose some neutral followers which they could indoctrinate with time.

2. Blue Team: Similarly, blue team can push a counter-narrative and interact with green team members. However, if they invest too much by interacting with a high certainty, they lose their "energy level". If they expend all their energy, the game will end. You need to model this in way that the game keeps going on while the blue team is changing the opinion of the green team members. Blue team also has an option to let a grey agent in the green network. That agent can be thought of as a life line, where blue team gets another chance of interaction without losing "energy". However, the grey agent can be a spy from the red team and in that case, there will be a round of an inorganic misinformation campaign. In simple words, grey spy can push a potent message, without making the red team lose followers.

Rubric:

Criteria	Excellent	Good	Satisfactory	Inadequate	Comments	Max Marks
Selection and design of appropriate AI technology	Good choice of design, with clear explanation and complete justification	Suitable choice of design with clear explanation and some justification	Suitable design chosen and explained, but justification lacking	Design is unsuitable, or not clearly explained.		10pts
Validation of Agent, including answers to the questions	Comprehensive tests, with insightful metrics	Good coverage of performance and complexity.	Some tests given, but results inconclusive or incomplete	Few or no tests, or no meaningful metrics used.		20pts
Implementation of agent	Complete and correct implementation with best practice data structures used.	Complete and well formatted code with suitable data structures	Mostly correct code with adequate data structures and algorithms	Not formatted or incomprehensible code, with flawed data structure choice		10pts
Agent Design	Best practise data structures and algorithms, challenging, non- trivial code and ability to learn strategies from the past simulations	Best practise data structures and algorithms,	Sound choice of data structures and algorithms, pragmatic design decisions	Substandard data structures and algorithms, or trivial basic code.		10 pts
Performance of Agent when playing with a human	Runs and performs at an excellent level with challenging play	Runs and generates realistic strategic play	Runs with some non-trivial strategic play	Does not run or trivial strategy		10 pts
Extra credit	Excellent Visualisation on a grid, along with current parameters	Good visualisation and display of parameters	Weak attempt at visualisation/display of parameters	Not a satisfactory attempt at visualisation or display of parameters		10pts

Input:

In order to run automatic simulations you only need the following inputs:

1. Number of agents in the green team and probability of connections (n,p)
2. Number of agents in the grey team and proportion of agents who are spies from the red team

3. Uncertainty interval (e.g, a tight interval such as [-0.9, 0.1], or a broad interval such as [-0.5, 0.5]). To make it simple, the more positive a value is the more uncertain the agent is and the more negative the value is the more certain the agent is.
4. Percentage of agents (green) who want to vote in the election, at the start of the game.

In order to learn more about your agents, you can run multiple simulations on varying parameters and analyse the results.

For a human to play as a red or a blue agent, you need to display a list of options to the player at their turn. For a blue agent, the options will consist of a) - 10 correction messages (Please come up with some fictitious messages), uncertainty value and associated energy loss, b) a choice to introduce a grey agent in the game play. For a red agent, the options will consist of a) - 10 pieces of misinformation (Please come up with some fictitious messages), uncertainty value and followers loss.

Output:

- Working Code
- Snap shot of all parameters at any given time, should we desire to have a look.
- An approximately 3000 words essay describing your game, addressing the rubric and explicitly answering the following questions:

    1. How does the game change if you have a *tight* uncertainty interval at the beginning of the game?
    2. How does the game change if you have a *broad* uncertainty interval at the beginning of the game?
    3. What effect a zero uncertainty has on the game play.

    Plot distribution of uncertainties for each of the above question.

    4. In order for the Red agent to win (i.e., a higher number of green agents with opinion “not vote”, and an uncertainty less than 0 (which means they are pretty certain about their choice)), what is the best strategy?
        a. Discuss and show with simulation results how many rounds red agent needs in order to win?
    5. In order for the Blue agent to win (i.e., a higher number of green agents with opinion “vote”, and an uncertainty less than 0 (which means they are pretty certain about their choice)), what is the best strategy?
        a. Discuss and show with simulation results how many rounds blue agent needs in order to win?
        b. What impact did grey agents have on the simulation?