Data-Driven Innovation: Assignment 3
Simulation Analysis

Task

The task is to simulate the sort of famous game called Among Us. The principle is that the simulation has a set of agents and each of them has to do some task. Among these agents are one or two killers that are trying to kill all the other agents and prevent them to finish their tasks. The goal of the assignment is to see how long it will take and under what parameter settings, 80% of living agents have the same belief about the identity of the impostor.

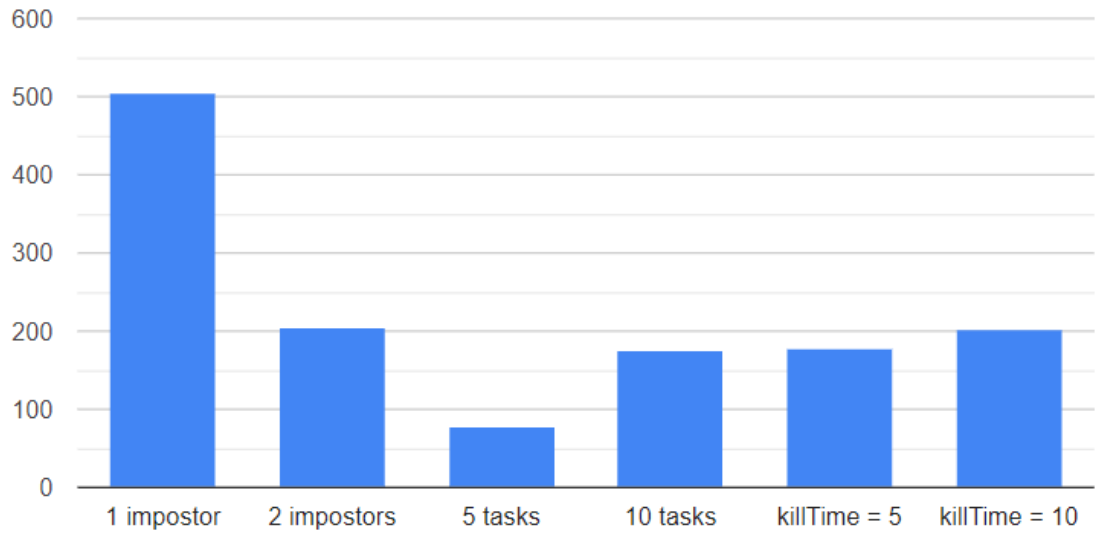
Parameters for simulation

For the implementation of this simulation, several parameters were specified, on which the rules of the game are based. Main participants of the game are called citizens and killers. Among the parameters that can change their values and affect the outcome of the game are:

- Number of players (slider ‘players’ with maximum 10 people)
- Number of killers (slider ‘killerPlayers’ with maximum 2 players)
- Number of tasks (slider ‘tasksNumber’ with maximum 20 tasks)
- Distance of citizens vision (input ‘howFarCitizenSees’ with numerical value)
- Distance of citizens belief sharing (input ‘shareBeliefDistance’ with numerical value)
- Amount of time to kill for killers (input ‘killTime’ with numerical value)
- Amount of time to pass before killing again for killers (input ‘timeBeforeKillAgain’ with numerical value)

Analysis

In order to study the different outcomes of the game with variable parameters, several game simulations were performed. On the following histogram you can observe how changing each some of the parameters affects the victory of the citizens and how much time in ticks is needed for them to win the game.



Number of players

The fewer players, the more likely the impostor will win, since the number of killers remains the same, and the less time it takes for the killer to overtake his victims.

Number of killers

If we take the initial value of killers as 2, while reducing their number to 1, the citizens have an increased chance of winning, since they will be able to get to the tasks being performed more safely or identify the killer in a shorter time.

Number of tasks

An increase in the number of completed tasks in the game for citizens negatively affects the chances of their victory using this method. If there are too many tasks, then the agents will be able to win faster if they watch the rest of the players and share their beliefs, and when the tasks are less than the number of agents, the chance of winning by completing these tasks increases significantly, and the citizens can win in a shorter time before the killer can eliminate everyone.

Distance of citizens' vision

As the distance of the agents' vision increases, the killer becomes more often seen by the citizens, and the chances of his victory are significantly reduced. Thus, the beliefs of the agents are quickly sent to the matrix of beliefs and in a short time the impostor is eliminated with the help of the values of beliefs and the citizens gain a victory.

Distance of citizens belief sharing

The greater the distance the agents exchange information, the less distance they need to cover in order to spread their knowledge about the killer. It can be compared to making a phone call instead of approaching each citizen personally. Thus, in a short time, the belief of the citizens is gathered, and the killer is quickly eliminated.

Amount of time to kill for killers

The less time is given to the impostor to eliminate the victim, the faster he will win, since he will be unnoticed at the crime scene and citizens will not be able to spread information about the killer if they do not see the killer next to the victim.

Amount of time to pass before killing again for killers

Increasing the value of this parameter reduces the chances of the assassins winning, since they will need to wait a while before killing again. During this time, residents can manage to complete their tasks and, due to this, win the game.

In addition, the layout of the walls and the landscape of the rooms also affect the outcome of the game. Since players move randomly when there is no stimulus, situations can arise where they get stuck in rooms and cannot get out, as a result of which one of the parties has an advantage if they are close to their targets. For example, if an impostor gets stuck in one of the rooms, and the agents can move freely, the chance of the villagers winning increases. But cases are not excluded when the inhabitants also cannot get out of the rooms, and the killer destroys

everyone, gaining a victory. Thus, in this simulation, you can set additional rules for the movement of players to avoid such situations.