**Crowd Evacuation Conflicts Simulation Based Cellular Automaton Integrating Game Theory**

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Crowd gathering activities are a common part of our everyday lives. With modern technology we are able to gather more and more people in one place. Getting people safely out of these areas in the case of an emergency can be challenging especially with high density exit points. Emergency situations can cause people to act irrationally and can get people hurt or even killed. In 2015 a human stampede in Saudi Arabia over 1000 people were killed and over 2000 people were injured.

Our project is based on the paper “Crowd Evacuation Conflicts Simulation Based Cellular Automaton Integrating Game Theory.” The paper goes into how evacuation plans can increase evacuation efficiency and increase safety. We plan to dive into cellular automata and game theory to create a model that would solve the conflicts caused by pedestrians during an evacuation.

To simulate our evacuation we will use a cellular automata using our cells as our pedestrians which will need to evacuate a room. The cell’s movement will be dependent on the pedestrian's behavior which is determined by a game rule similar to the prisoner’s dilemma. The game is based on two options: whether to cooperate or defect. If you both cooperate you both move towards the exit. If one cooperates and the other decides to defect, the defector moves towards the door and the cooperator doesn’t move. If you both defect you both don’t move.

When actually conducting simulations the environment is first set up as a two dimensional grid with one or more exits and agents. Some of the variables that can be toggled are the number of agents, ratio of cooperative to defective agents, the penalty factor, inertia, radius of view, and familiarity factor.

The P factor represents the payoff when both agents defect, having a high value for P decreases the attractiveness of defecting and thus decreases the likelihood of everyone defecting. The inertia defines how resistant agents are to changing their strategy after encountering a conflict, the higher the inertia the less likely agents are to switch strategies. The familiarity factor is used to represent agents familiarity with the exit although this is kept constant for this experiment. The radius of view dictates how far each agent can perceive their surroundings. Not being able to see an exit results in less efficient moves.

We plan to recreate these simulations with a few different environments and try different parameters, with the goal of recreating the results from the paper. These results show that higher proportions of initial cooperators result and larger radius of view lowers evacuation times.

Some potential future work includes adding more agent types to more closely represent real world behaviors. Also adding more external influencing factors such as exits becoming blocked, increasing panic as time proceeds, and more intricate environments. Also this paper does not discuss much about the familiarity factor but that could be an interesting variable to investigate.