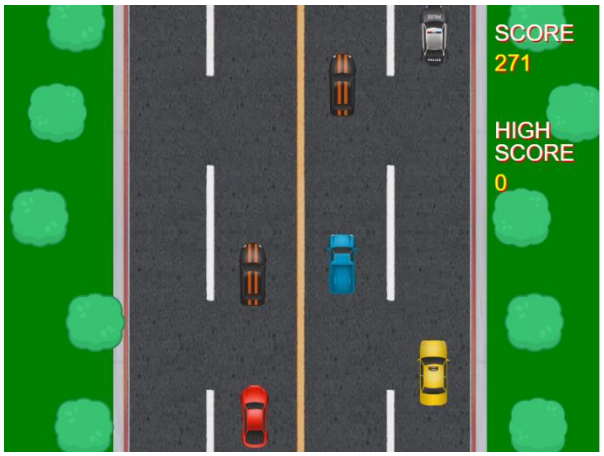
Self-Driving car in a Game Environment

Anirban Mookherjee and Murtaza Shams

Introduction:

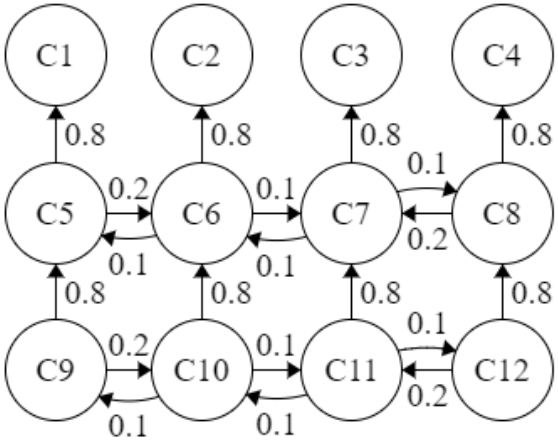
Our goal for the project was to create a self-driving car in a traffic racing game. Such games have a single agent that controls a car to change lanes and avoid collision with other cars. The only actions available to the agent are move left or move right. The performance of the agent is determined by the score shown at the top right.



As the game progresses, the relative speed of the agent car increases, making the game more challenging. With the introduction of an AI agent we have demonstrated their dominance in an environment that needs quick response times.

Approach:

Our AI agent uses a meticulously designed evaluation function to determine the most optimal lane in each time frame and then moves the car accordingly. The road ahead of the agent car is divided into 16 cells, spread into 4 rows and 4 columns. Cells with traffic cars in them have a high negative reward proportional to their distance from the agent car. Remaining cells get their values by performing value iteration, using an evaluation function that uses a weighted sum of adjacent cell values.



C1 to C4 take a positive value if empty or else a negative value proportional to the speed of the car present in that cell. Outward arrows show where each cell calculates its U(Utility) from. For example:

$U(C_6) = 0.8U(C_2) + 0.1U(C_5) + 0.1U(C_7)$.

$U(C_{12}) = 0.8U(C_8) + 0.2U(C_8)$.

AI agents next best state is Max (C_9, C_{10}, C_{11}, C_{12}) and will move the car to that position when there are no other cars in between,

Results:

The AI agent was run for 157 games and performance evaluated. The statistics being:

Average	Min	Max
5549.217	567	30778

We played the game ourselves and recorded the times as:

Average	Min	Max
3600	487	6868

The AI agent achieves a better average and a much better high score. The min score is identical for the random case where collision is unavoidable.

Ethics

The use of such AI may be unethical if used to score higher than humanly possible in competitive games with leaderboards and other score based bragging.