AIS201: ARTIFICIAL INTELLIGENCE-
2023SPRG

CAR RACING USING GENETIC ALGORITHM

NILE UNIVERSITY

Meet Our Team

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INTRODUCTION

What is a genetic algorithm?

What are the key components of a genetic algorithm?

What are some real-world applications of genetic algorithms?

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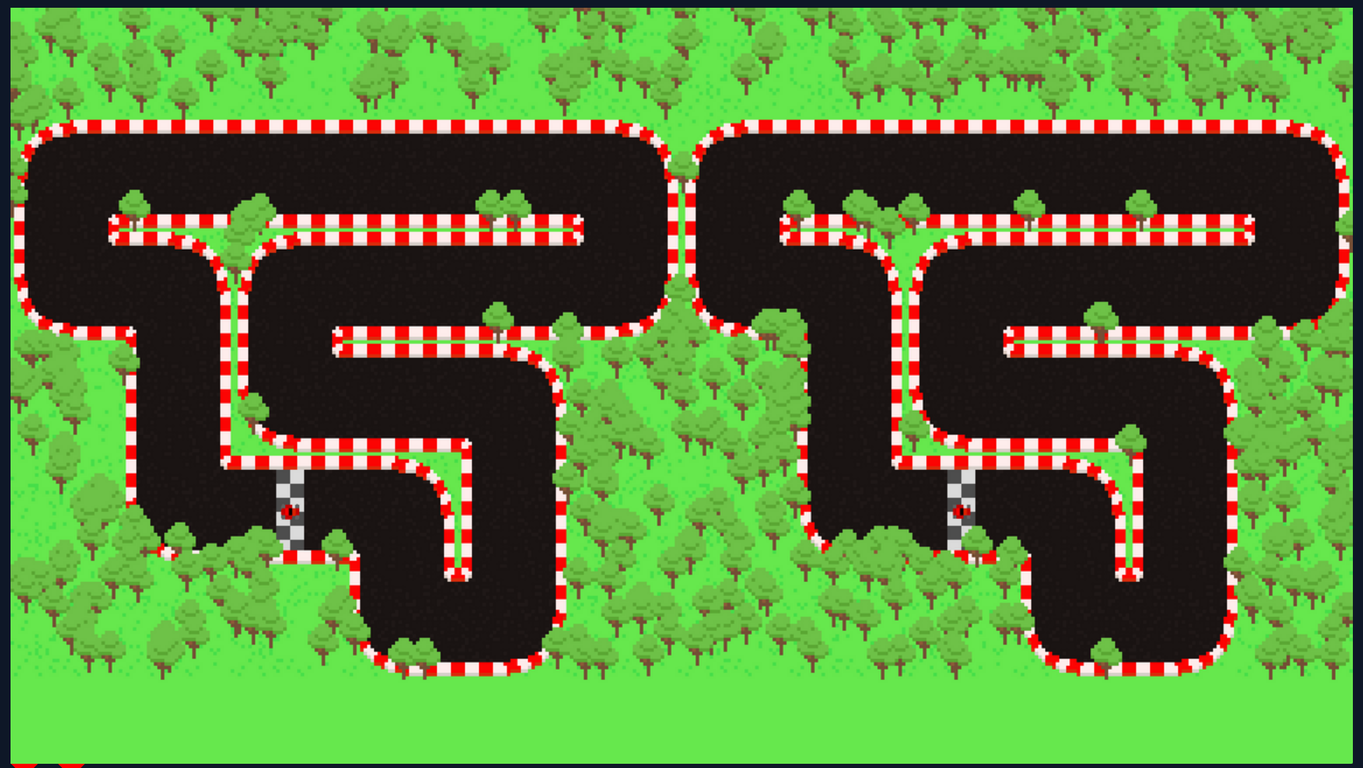
PROBLEM STATMENT

- Implement an AI-controlled car racing game.
- Navigate the car through a track with walls and checkpoints.
- Use artificial intelligence techniques to make intelligent decisions.
- AI cars should find the closest checkpoint.
- Calculate the appropriate angle and velocity to reach the checkpoint.
- Adjust the car's position and angle based on the calculations.
- Provide a visual representation of the track, walls, and AI cars.



BREAK SLIDE

Racing Game

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LIBRARIES USED

- Import pygame, math, random, os, and the Image class from the PIL module.
- Define and initialize variables used throughout the code.

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VARIABLES

- windowSize: Specifies the dimensions of the game window.
- pixelSize: Determines the size of individual pixels on the screen.
- tilePixels: Defines the size of each tile in terms of pixels.
- tileSize: Represents the size of each tile in the game world.
- fps: Sets the desired frames per second for smooth gameplay.
- quit: A flag variable used to control the game loop and determine when to exit the game.
- fillColour: Specifies the RGB color value used to fill the game window background.

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VARIABLES

- humanCar: A boolean variable indicating whether a human-controlled car is included in the game.
- track1Pos and track2Pos: Determine the positions of the two tracks within the game window.
- treeDensity: Specifies the number of trees to be placed on the tracks.
- numberOfCars: Defines the number of cars present in each generation.
- carCutoff: Determines the number of cars to keep for the next generation, based on their performance.

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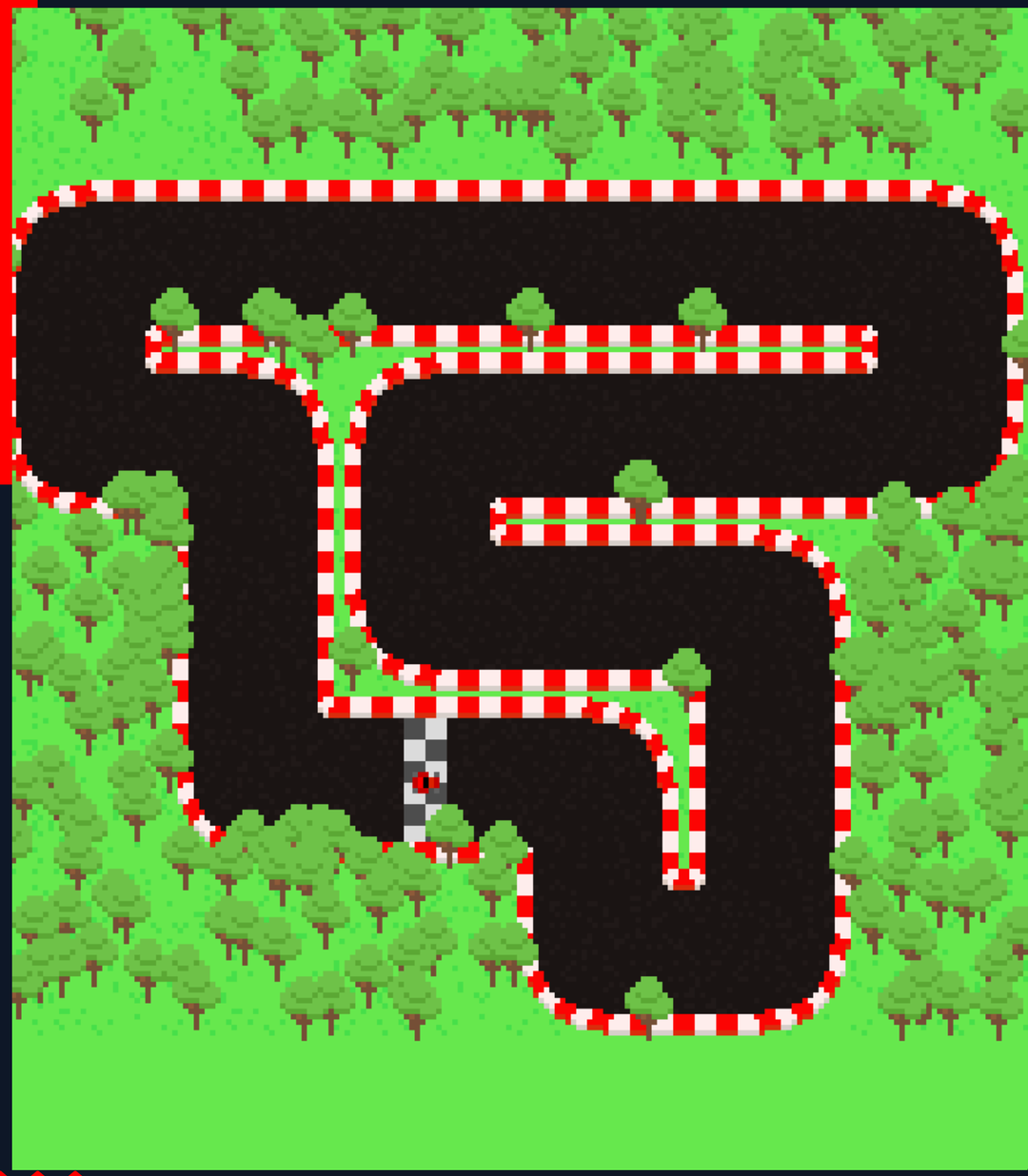
TRACK AND CHECKPOINT

The code defines the track and checkpoints for the racing game.
track is a 2D list representing the layout of the track.
Numbers 0-6 represent different tiles.
checkpoints is a list of coordinates representing the positions of the checkpoints on the track.



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RACING GAME

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STARTING POSITION

The code finds the starting position on the track for the cars.

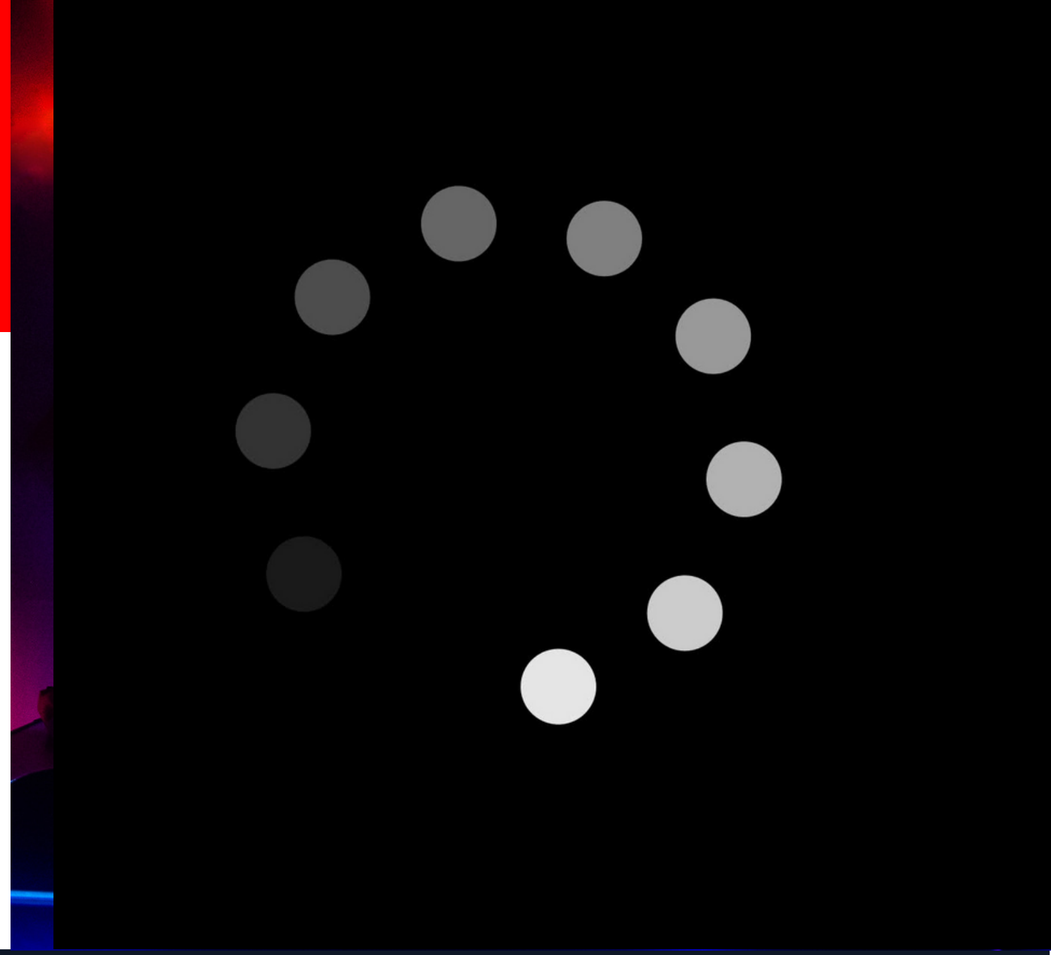
It iterates over the track and finds the tile with a value greater than or equal to 7.

*The starting position is set to the center of that tile, and the starting angle is set to 0.

LOADING IMAGES

The code loads the images used in the game, including ground tiles, wall tiles, and the car sprite.

It uses a list comprehension and the pygame.image.load function to load multiple images



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PYGAME SETUP

The code performs setup for the Pygame library.

It creates a Pygame clock object for controlling the frame rate.

It centers the game window on the screen.

It creates the game window using the specified window size.

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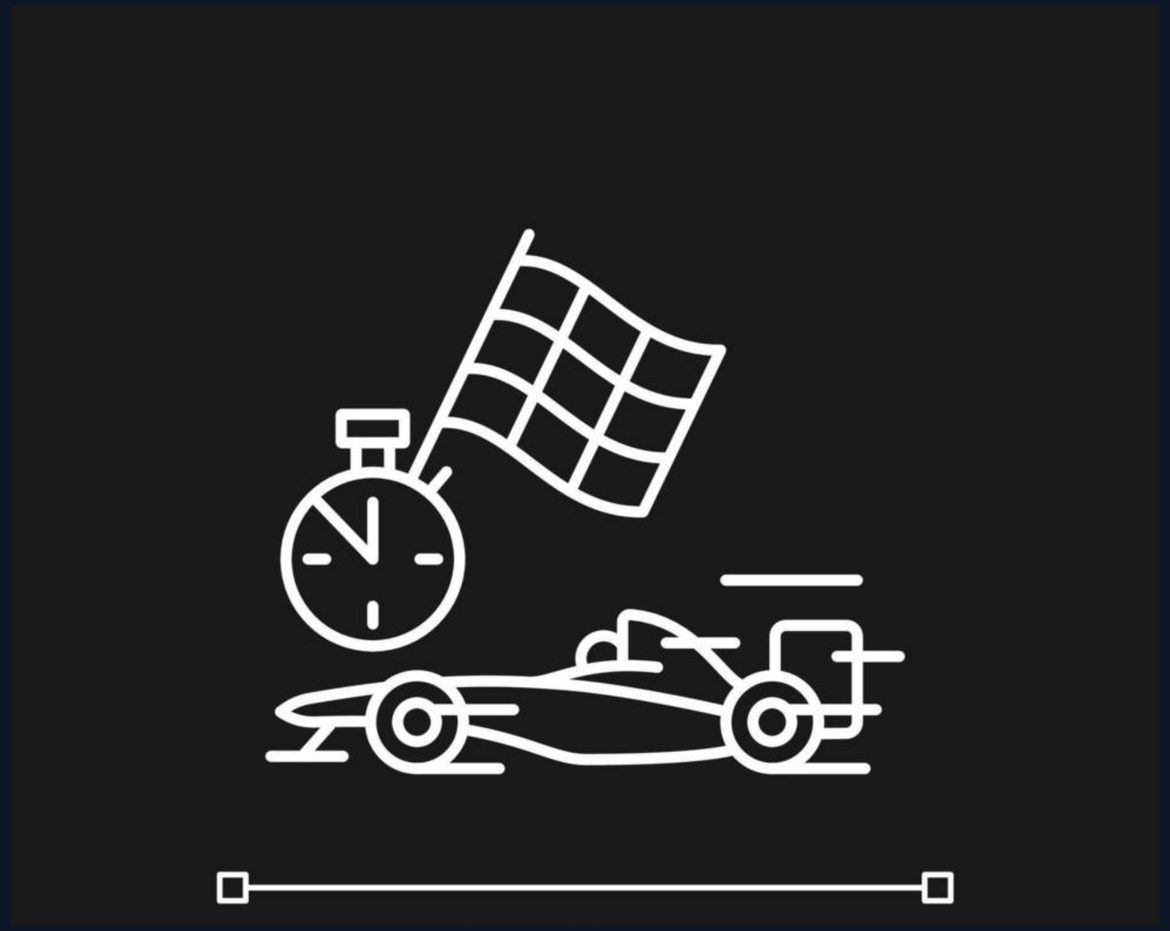
CAR OBJECT

- The code defines a car class representing the cars in the game.
- The car object has various attributes and methods for controlling its behavior.
- The __init__ method initializes the car with the given position, angle, and brain.
- The car's movement is controlled by the inputs method, which takes an array of directions as input.
- Other methods handle acceleration, deceleration, turning, collision detection, checkpoint handling, scoring, and drawing.



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BIASED RANDOM FUNCTIONS

- biasedRandom() generates random values with bias towards a specific range.
- It takes minValue, maxValue, and bias as parameters.
- It calculates the range length by subtracting minValue from maxValue.
- Generates a random number between 0 and 1.
- Applies bias by raising the random number to the power of bias.
- Multiplies the biased random number by the range length.
- Adds minValue to obtain a random value within the desired range.

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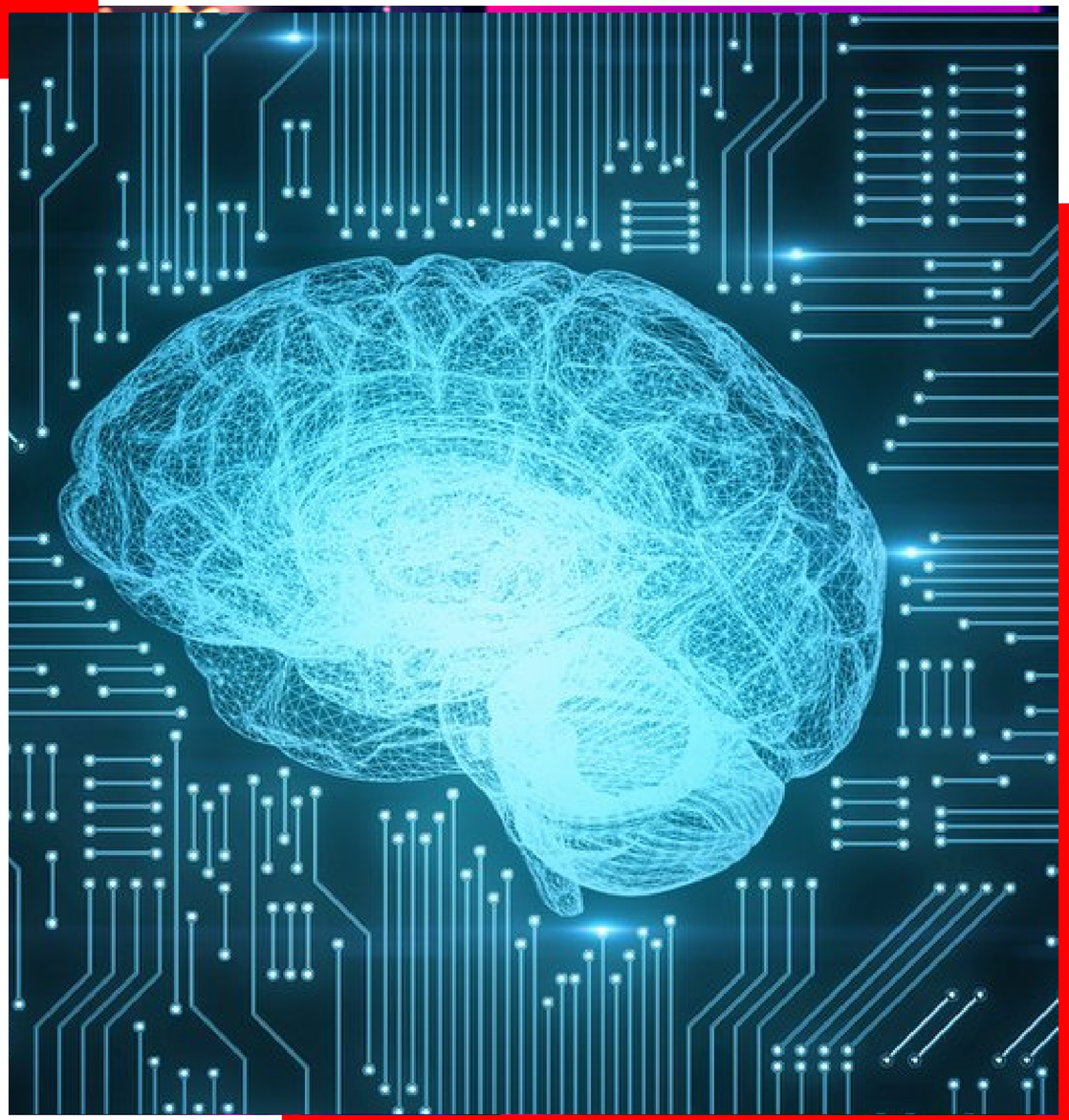
MUTATION FUNCTION

- The mutate() function introduces random changes to the car's brain to add diversity.
- It iterates a specified number of times and randomly selects brain inputs to modify.
- Selected brain inputs are assigned random values (-1 to 1) for direction control.

NEW GENERATION

- The newGeneration() function transitions from one generation to the next.
- It sorts the cars based on their scores and selects the top-performing ones.
- It mutates the selected cars and creates new ones to fill the population.
- It updates the generation count and necessary variables.
- The next generation of cars is then ready for evaluation and simulation.



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RACING GAME

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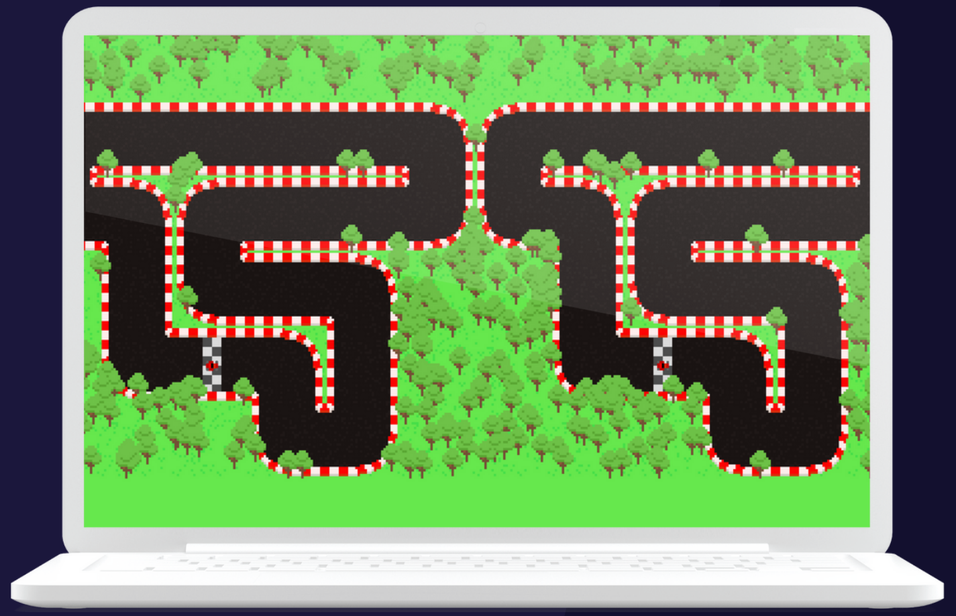
MAIN LOOP

- The main loop runs the simulation and updates the cars.
- It checks for quit events to exit the program.
- It executes the brain inputs of each car and moves them accordingly.
- It updates the scores of each car based on their progress and time.
- It updates the display to show the positions of the cars.
- It limits the frame rate to maintain a specified speed.



CONCLUSION

Genetic algorithms optimize the performance of autonomous cars in a racing track.

Selection, crossover, and mutation drive the evolution of car populations

Neural networks enable cars to make intelligent decisions and improve over generations


THANK YOU FOR
PLAYING WITH US!
EXIT