IMPLEMENTATION AND ANALYSIS OF GENETIC ALGORITHMS

Synopsis of Project

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Introduction

The genetic algorithm is a method for solving both constrained and unconstrained optimization problems that is based on natural selection, the process that drives biological evolution. The genetic algorithm repeatedly modifies a population of individual solutions. At each step, the genetic algorithm selects individuals at random from the current population to be parents and uses them to produce the children for the next generation. Over successive generations, the population "evolves" toward an optimal solution. We can apply the genetic algorithm to solve a variety of optimization problems that are not well suited for standard optimization algorithms, including problems in which the objective function is discontinuous, nondifferentiable, stochastic, or highly nonlinear.

Objective and Scope

- Using a genetic algorithm to generate a string which is the closest match to the user input string from a set of randomly generated strings.
- To deploy genetic algorithm to tackle route optimisation problem.
- To train a simulated car model to prevent obstacles and cover its path.
- To analyse the accuracy, speed and fitness of successive generations by varying various parameters such as size of each generation, number of recombining genomes, mutation level, etc.

Implementation

Using Unity3D, we aim to create to an Android application interface that will perform the following tasks-

- Allows user to input a string and tweak parameters for the genetic algorithm and see the intermediate generations till the end result.
- Allows user to select a set of points on a plane and find the shortest connecting path between them.
- Shows a 3D car model learning to behave as per its surroundings using genetic algorithms.

Utility

- Genetic algorithm will help find a close to optimal route between various destinations in very short time which can be used by people in delivery business to optimise their journey.
- Genetic algorithms will help train a simulated car model to prevent obstacles by reading data from its 3 or more sensors and eventually drive the entire path without colliding which can then be used in self driving cars.

Advantages

- Genetic algorithms can find fit solutions in a very less time which are good according to the defined heuristic.
- The random mutation guarantees to some extent that we see a wide range of solutions.
- They can be applied to solve a variety of optimization problems such as problems in which the objective function is discontinuous, nondifferentiable, stochastic, or highly nonlinear.

Disadvantages

- It might not find the most optimal solution to the defined problem in all cases.

- Genetic algorithms are computationally expensive i.e time consuming.

References

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