Research on Application of Artificial Intelligence Algorithm In Directed Graph

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Abstract- *With the development of artificial intelligence algorithm, the combination of intelligent algorithm and directed graph has become an important tool of current path planning. The application of the intelligent algorithm affects the optimal path planning in the directed graph, including the length of the optimal path and the time of the operation of the algorithm. The following studies are carried out through this paper based on the application of intelligent algorithm in directed graph. In the experimental environment of MATLAB, the coordinates of 30 target points are generated by random numbers. The ant colony algorithm and genetic algorithm are used to make the optimal path planning for the 30 target points, and the starting point and the end point are fixed to form a directed and closed graph. The parameters of the two algorithms are adjusted accordingly. Comparison of the two algorithms of the optimal path diagram and the algorithm running time, so as to draw the conclusion of the optimal algorithm.*

Keywords- Artificial Intelligence, Intelligence algorithm, Optimal algorithm

I. INTRODUCTION

With the quick advancement of Artificial Intelligence in present day science and innovation, the promotion and learning of Artificial Intelligence has been connected broadly. The issue be explained by Artificial Intelligence calculation as a rule is improvement issue. Computerized reasoning calculation is generally utilized in functional application which include numerous parts of subjects from mathematic to neuropsychology. In current life, individuals attempt to utilize machine to supplant some portion of human's psychological work. After quite a while of investigating and creating, Artificial Intelligence calculation is winding up progressively develop and impeccable. There is no uncertainty that man-made brainpower takes up the vast majority of our lives.

Today, fields of computerized reasoning calculation associated with different enterprises. In the use of digraph that contain a coordinated and shut line, man-made brainpower calculation assumes a job in finding the most brief way. In the situating and route of UAV, the essential capacity of smart calculation in coordinated diagram is way arranging. A large portion of these calculations are connected to delineate, looking for the most limited way for clients to achieve the goal with the quickest speed. Among of them, subterranean insect province advancement and hereditary calculation are utilized in the use of digraph.

Ants impart to each other by setting down pheromones along their trails, so where ants go inside and around their subterranean insect province is a stigmergic framework. In numerous insect species, ants walking around or toa nourishment source, store on the ground a substance called pheromone. Different ants can smell this pheromone, and its quality impacts the decision of their way, that is, they will in general pursue solid pheromone focuses. The pheromone stored on the ground frames a pheromone trail, which enables the ants to discover great wellsprings of sustenance that have been recently recognized by different ants. Subterranean insect conduct is appeared in Fig. 1. Utilizing arbitrary strolls and pheromones inside a ground containing one home and one nourishment source, the ants will leave the home, discover the sustenance and return to the home. After some time, theway being utilized by the ants will meet to the most limited way.

II ALGORITHMS

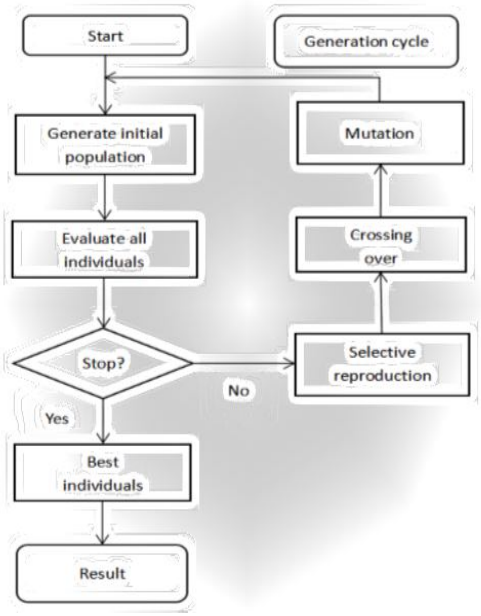
A. Ant Colony Optimization

Subterranean insect settlement advancement is a calculation used to locate the ideal way in the chart. It originates from the conduct of ants during the time spent discovering sustenance. Subterranean insect state advancement for the underlying course necessities are not high, that is, does not rely upon the decision of the underlying line. What's more, it doesn't require manual change in the inquiry procedure. Toward the start of the calculation, a solitary fake subterranean insect discover arrangement out of request. After a timeframe development, fake ants are increasingly more slanted to locate the ideal arrangement through the activity of pheromone. This is a procedure from turmoil to arrange. Insect province enhancement is another bionic calculation which is straightforward on a fundamental

level. It is anything but difficult to control the circumstance of being caught in a neighborhood ideal, and can locate the worldwide ideal arrangement with extraordinary likelihood. The term metaheuristic is a mix of two Greek words. Heuristic gets from the action word heuriskein which signifies "to discover", while the addition Meta implies"past, in an upper dimension". The new heuristic has the accompanying attractive attributes: • Versatile: It can be connected to comparative variants of a similar issue; for instance, there is a direct expansion from the voyaging sales rep issue (TSP) to the uneven voyaging sales rep issue (ATSP).

- *Robust*: It very well may be connected with just insignificant changes to other combinatorial advancement issues, for example, the quadratic task issue (QAP) and the activity shop booking issue (JSP).
- Population based methodology: This is fascinating in light of the fact that it permits the misuse of positive criticism as a hunt instrument, as clarified later in the paper. It additionally makes the framework amiable to parallel executions.

Ant system is the first member of ACO class of algorithms. This algorithm is inspired by the traillaying and following behavior of natural ants. The essential trait of ACO algorithms is the combination of a priori information about the structure of a promising solution with posterior information about the structure of previously obtained good solutions. The main underlying idea, loosely inspired by the behavior of real ants, is that of a parallel search over several constructive computational threads based on local problem data and on a dynamic memory structure containing information on the quality of previously obtained result.



The ants are driven by a probability rule to choose their solution to the problem, known as a tour. The probability rule between two nodes j, called Pseudo Random-Proportional

Action Choice Rule, and it depends on two factors: the heuristic and meta heuristic.

$$p_{ij} = \frac{[\tau_{ij}]^{\alpha}[\eta_{ij}]^{\beta}}{\sum_{h \in s}[\tau_{ij}]^{\alpha}[\eta_{ij}]^{\beta}}$$

Where t is the pheromone, η is the inverse of the distance between the two nodes. Each antmodifies the environment in two different ways:

i) Local trail updating: As the ant moves between nodes it updates the amount of pheromone on the edge by the following equation:

$$\tau_{ij}(t) = (1-\rho).\tau_{ij}(t-1) + \rho.\tau_0$$

Where, ρ is the evaporation constant. The value t0 isthe initial value of pheromone trails and can becalculated as:

$$\tau 0 = (n / L_n)\text{-}1$$

Where, n is the number of nodes and Ln the total distance covered between the total nodes, produced by one of the construction heuristics.

ii) Global trail updating: When all ants have completed all the nodes that find the shortest path updates the edges in its path using the following

equation:

$$\tau_{ij}(t) = (1-\rho).\tau_{ij}(t-1) + \frac{\rho}{L^+}$$

Where, L+ is the length of the best path generated by one of the ants.

B. Gentic Algorithm

Hereditary calculation as a bionic improvement is the learning of the naturally visible procedure of human development to demonstrate the self-capacity of taking care of issue. The system it duplicates that has a place with all the current life and insight is the procedure of development and appearance. By copying the Darwin's 'survival of the fittest' standard to energize better structure. By utilizing Mendel's hypothesis of hereditary variety, the current structure is kept in the iterative procedure, in the meantime, to discover and improve the better structure. Hereditary calculation as a stochastic streamlining and hunt strategy. A hereditary calculation is a heuristic inquiry technique utilized in man-made brainpower and processing. It is utilized for finding enhanced answers for inquiry issues dependent on the hypothesis of normal determination and transformative science. Hereditary calculations are incredible for seeking through expansive and complex informational collections. They are viewed as equipped for finding sensible answers for complex issues as they are very fit for comprehending unconstrained and compelled streamlining issues.

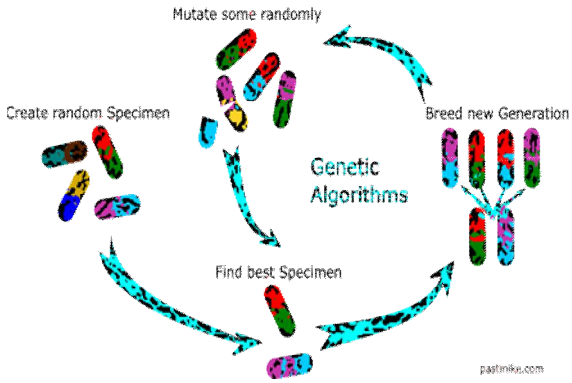
A hereditary calculation makes employments of strategies enlivened from developmental science, for example, determination, change, legacy and recombination to take care of an issue. The most regularly utilized strategy in hereditary calculations is to make a gathering of people arbitrarily from a given populace. The people subsequently shaped are assessed with the assistance of the assessment work given by the software engineer. People are then given a score which in a roundabout way features the wellness to the given circumstance. The best two individuals are then used to create one or more offspring, after which random mutations are done on the offspring. Depending on the needs of the application, the procedure continues until an acceptable solution is derived or until a certain number of generations have passed.

A genetic algorithm differs from a classical, derivative-based, optimization algorithm in two ways:

- A genetic algorithm generates a population of points in each iteration, whereas a classical algorithm generates a single point at each iteration.
- A genetic algorithm selects the next population by computation using random number generators, whereas a classical algorithm selects the next point by deterministic computation.

Compared to traditional artificial intelligence, a genetic algorithm provides many advantages. It is more robust and is susceptible to breakdowns due to slight changes in inputs or due to the presence of noise. With respect to other optimization methods like praxis, linear programming, heuristic, first or breadth-first, a genetic algorithm can provide better and more significant results while searching large multi-modal state spaces, large state spaces or n-dimensional surfaces.

Genetic algorithms are widely used in many fields such as robotics, automotive design, optimized telecommunications routing, engineering design and computer-aided molecular design.



III. APPLICATIONS

Drone services, also known as unmanned aerial vehicle (UAV) services, is the emerging market for services built around flying robots that can be remote-controlled or flown autonomously using software-controlled flight plans in their embedded systems. Commercial drone services are developing UAV services, sometimes called Drones as a Service, to help industries, such as agriculture, construction, search and rescue, package delivery, industrial inspection, insurance and videography, with tasks like collecting imagery and measurements and managing or broadcasting events.

IV.CONCLUSION AND FUTURE WORK

All the coordinates are generated by random number. Genetic algorithm and ant colony algorithm can be well

applied in directed graphs. However, comparing the two algorithms in the experiments above, we can see which algorithm is more suitable for the application of directed graph. It can be seen from the above two experimental results that the resulting digraph is the same, but the shortest path is different. From the point of view of the length of the path, the path length of the genetic algorithm is shorter than the ant colony optimization to 1.8521. From the point of view of the running time of the algorithm, although the computational complexity of the genetic algorithm is 5 times than that of the ant colony algorithm, the ant colony optimization consumes much less time than the genetic algorithm. After a simple conversion, we found that the ant colony optimization takes less than half the time of the genetic algorithm.

The genetic algorithm can search a good solution with sufficient number of operations, but the operation time is too long. However, the ant colony algorithm has shown good performance, and can find good solutions in a few iterations. Genetic algorithm and ant colony optimization are effective searching algorithm in solving the problems such as TSP when they each one has his good points. To sum up, the ant colony optimization is better than the genetic algorithm in the application of directed graph. When the shortest path graph is drawn, the ant colony optimization can run the algorithm in a short time. Although in the computation of the length of the shortest path, the ant colony optimization is not as good as the genetic algorithm, in the same digraph, the subtle difference may be due to errors. Therefore, the ant optimization is more suitable for the application of directed graph.

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