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Path Identification Between Cluster Heads Using Improved A* And K-Means With Obstacle Mapping

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ABSTRACT

The aim of the project is to find optimal path to reach the enemy's place in the war field. It can be done by clustering the vehicles in enemy base by using K-means clustering and the optimal path can be found by using the improved A algorithm. The input of this project is the satellite image of an enemy's base. In this image we can easily identify the location of the enemy's vehicles. By using that location we can fix the destination to reach.*

The advantage of clustering the enemy's vehicle is used to reduce the time to traverse the node (here vehicle is considered as a node) and we easily reduce the number of paths. The k-means clustering is most commonly used clustering method and the formula we used to cluster the node is very simple to calculate.

In this project the ultimate aim is to find the optimal path instead of finding the shortest path. Finding the shortest path is not efficient because the shortest may have some difficulties like having some snowfall, mountain, Lake Etc. so we need to find the optimal path. We use improved A algorithm to find the optimal path. Reason for choosing this algorithm is here we don't have single destination and clusters are movable. So improved A* algorithm is feasible to find the optimal path.*

This project can be nearly based on image processing because we can process the input in the form of image format. And the output of the project is clearly said which is the optimal path to reach the enemies to attack them.

KEYWORDS- clustering the vehicles, optimal path identification.

1. INTRODUCTION

The optimal path to reach the all available nodes can be done after the clustering of the nodes. The clustering can be done by using the k-means clustering. K-means clustering is a

method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. K-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells.

The problem is computationally difficult (NP-hard); however, there are efficient heuristic algorithms that are commonly employed and converge quickly to a local optimum. These are usually similar to the expectation-maximization algorithm for mixtures of Gaussian distributions via an iterative refinement approach employed by both algorithms. Additionally, they both use cluster centres to model the data; however, k-means clustering tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes.

And the optimal path of the each cluster can be found by using the improved A- star algorithm. With the development of automated logistics systems, flexible manufacture systems (FMS) and unmanned automated factories, the application of automated guided vehicle (AGV) gradually become more important to improve production efficiency and logistics automatism for enterprises.

An improved A-Star (A*) algorithm is proposed, which introduces factors of turning, and edge removal based on the improved A* algorithm is adopted to solve k shortest path problem. Meanwhile, a dynamic path planning method based on A* algorithm which searches effectively the shortest-time path and avoids collision has been presented. Finally, simulation and experiment have been conducted to prove the feasibility of the algorithm.

2. SCOPE OF THE PROJECT

The scope of the project path identification between cluster heads using improved a* and k-means with obstacle mapping is for identify the optimal path. The application is take care about the movements of enemies and it provides the way to attack in the feasible way.

The A* algorithm can show the all available path and locate the exact optimal path to travel. It can also change path randomly based on the movement of the cluster.

3. SYSTEM ANALYSIS

EXISTING SYSTEM

The military grid reference system (MGRS) is the geo-coordinate standard used by NATO militaries for locating points on the earth. The MGRS is derived from the Universal Transverse Mercator (UTM) grid system and the universal polar stereographic (UPS) grid system, but uses a different labeling convention. The MGRS is used for the entire earth.

An example of an *MGRS coordinate*, or *grid reference*, would be 4QFJ12345678, which consists of three parts:

- 4Q (grid zone designator, GZD)
- FJ (the 100,000-meter square identifier)
- 12345678 (numerical location; easting is 1234 and northing is 5678, in this case specifying a location with 10 m resolution)

4. MAIN FEATURES OF PATH IDENTIFICATION BETWEEN CLUSTER HEADS USING IMPROVED A* AND K-MEANS WITH OBSTACLE MAPPING

- The nearest node can be clustered together.
- Each cluster can be considered as a node.
- The time to take traverse the all node is less.
- The optimal path can be identified for the movable clusters.
- The current situation can be updated quickly.
- It can consider each hazard in between the path.
- And it can eliminate the path which can contain more difficulties to travel.

5. IMPLEMENTATION

CLUSTERING

The clustering can be done by using the k-means clustering. K-means is one of the simplest unsupervised learning algorithms that solve the well-known clustering problem. The procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed A-priori. The main idea is to define k centers, one for each cluster. These centers should be placed in a cunning way because of different location causes different result. So, the better choice is to place them as much as possible far away from each other. The next step is to take each point belonging to a given data set and associate it to the nearest center. When no point is pending, the first step is completed and an early group age is done. At this point we need to re-calculate k new centroids as barycenter of the clusters resulting from the previous step. After we have these k new centroids, a new binding has to be done between the same data set points and the nearest new center. A loop has been generated. As a result of this loop we may notice that the k centers change their location step by step until no more changes are done or in other words centers do not move any more. Finally, this algorithm aims at minimizing an objective function know as squared error function given by:

Volume: 4, Issue: 3,Special Issue: 2 ,Apr,2016 ,ISSN_NO: 2321-3337

$$J(V) = \sum_{i=1}^{c} \sum_{j=1}^{c_i} (\|x_i - v_j\|)^2$$

where,

'$||x_i - v_j||$' is the Euclidean distance between x_i and v_j.

'c_i' is the number of data points in i^{th} cluster.

'c' is the number of cluster centers.

WEIGHTAGE CALCULATION

The weightage of the cluster can be calculated based on the criteria is total number of nodes in the cluster.

The number of nodes in the cluster can be found by count the nodes in the same color
The formula can be used to calculate the weightage is

$$N=\sum y_i$$

y_i => individual node in the cluster.

CLUSTER CENTROID

The cluster centroid is the middle of a cluster. A centroid is a vector containing one number for each variable, where each number is the mean of a variable for the observations in that cluster.

You can use the centroid as a measure of cluster location. For a particular cluster, the average distance from the centroid is the average of the distances between observations and the centroid. The maximum distance from the centroid is the maximum of these distances.

$$Y' = \sum Y_i \, A_i \text{ where } A_i$$

A_i= the individual segment's area

Y_i= the individual segment's centroid distance from a reference line are datum

CLUSTER SIZE

The size of the cluster can be calculated by compare the distance between the cluster centroid and all the cluster members, which distance is high that can be taken as the radius for the area of the cluster. The area of the cluster can be considered as the size of a cluster.

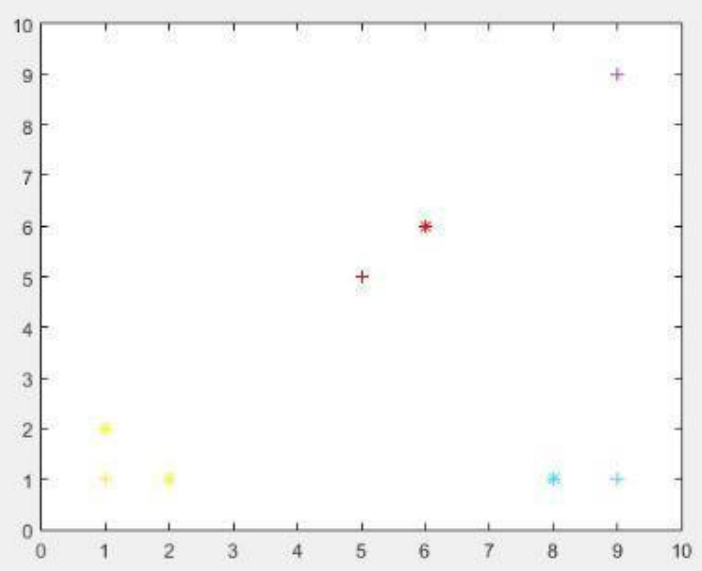
The formula used to calculate the cluster size is

Volume: 4, Issue: 3,Special Issue: 2 ,Apr,2016 ,ISSN_NO: 2321-3337

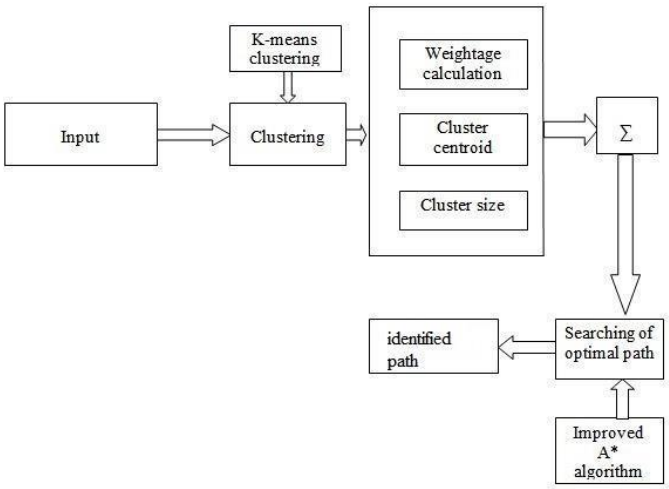
$$\text{For each } C_s = Y' \left[\frac{N \times \sum \Delta (N-n)}{r \times \Delta d} \right]$$

N => no of nodes Δd => mean distance

After the nodes are clustered the output should be



6. SYSTEM ARCHITECTURE



7. CONCULSION AND FUTUREWORK

By this application, in the time of war our army soldiers can easily able to find the optimal path to reach the enemies to do the attack. This application can provide the path to reach the all vehicles of the enemies. It can cluster the nearby vehicles and consider as a single node and it can easy to find the optimal path in the minimum amount of time. And it also provided the weightage and size of the cluster, this information can be used to select how much force and what are the forces are need to do the attack and defeat the enemies easily.

The future goal the project is instead of give the input by us the application can directly get the image from the satellite and show the optimal path for the destination. And the optimal path is applicable for all the three states viz land, water and air. This application is not only for army, it is also for navy and air force.

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