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Image Analysis Using Ant Colony Optimization Algorithm: Pictorial Illustration about the Status of a Region

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Abstract: **In the new era, technology is growing rapidly making everyday work easier or more efficient. There are still a lot of prospects to implement all the innovative ideas for our state. For this reason it is necessary to advance a whole new outlook for developing the technologies we have with us. This paper illustrates a method to provide a segmentation of Satellite images using Ant colony algorithm as a part. The proposedmethod helps in segmentation of Images. By using proposed method on satellite images itgenerates segmented images of the satellite image. This data can be analyzed and necessary action can be taken for the betterment of the state.**

Key words- **image, image analysis, Satellite, ant colony algorithm, Edge detection.**

I. INTRODUCTION

At present, Maharashtra state is facing a lot of difficulties regarding each and every factor which relates to making this state one of the most developed states in the world. Maharashtra is a cosmic land with many significant variations, be it the agricultural area, the water boundaries. Therefore, there is a lot of scope to use the given exceptional geographical variations properly.

Traditional ground-based methods of gathering information and mapping rural areas are no longer sufficient to serve the requirements of regional authorities. The concept of images is not new to the human mind. Satellites have also become a convenient way for data transmission due to rapid development of modern technology. Using these two technologies we can accomplish our aim of image analysis. Image investigation is the taking out of meaningful information from images ;primarily from digital images by means of digital image analysis techniques. Image analysis exercise can be as elementary as analyzingbar codelabels or as sophisticated as classifying anindividual from their face. Ant behavior was the inspiration for the metaheuristic optimization technique [1].

In computing technology and operations research, the ant colony optimization algorithm (ACO) is a probabilistic technique for solving computational problems which can be reduced to finding better paths through graphs. In this paper, ACO is used to identify the image edge detection problem, where the aim is to extract the edge indication presented in the image Collaborating the concept of ant colony algorithm for image analysis, we will be able to get a very vivid and clear overview image of Maharashtra State. These images taken at particular intervals regularly will be able to divide the variations of the state specifically.

The administration can productively use these images for analyzing which part of the state needs more attention and which is self-sufficient. The government instead of blindly investing their hardwork and money without a proper plan or necessary documents can use this technology to properly analyze the state and take necessary actions.

Following this procedure the government can help develop all the different parts of the state and also keep track of any sudden variations in any area.

The proposed method is based on image analysis using an ant colony algorithm. Our analysis comparing the before and after of the implementation of the method shown in this paper increases the economic growth rate of the state of Maharashtra, while at the same time providing a helping hand to the government. In Figure 1 the satellite view of Maharashtra State is captured.

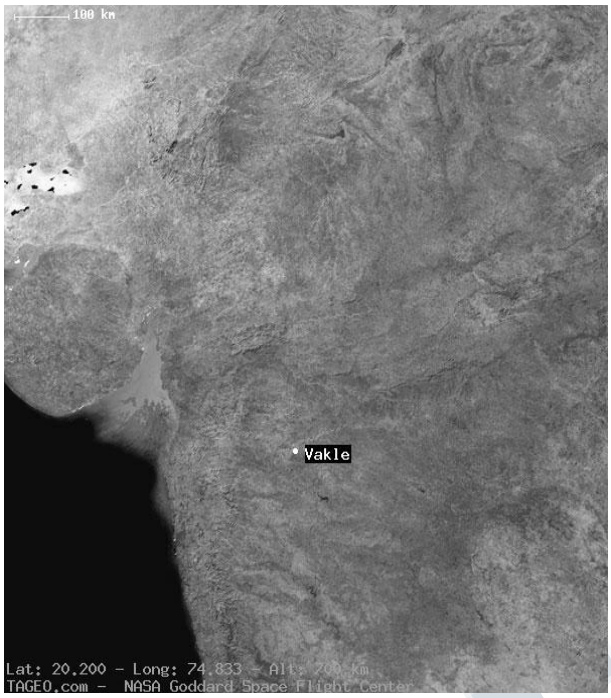

Fig.1 Satellite view of Maharashtra state

II. IMAGE ANALYSIS

Image analysis is the extraction of meaningful information from images;primarily from digital images by means of digital image processing techniques. Image analysis exercise can be as elementary as interpretationfrom cardiogram or as sophisticated as identifying a person from their picture [1].

Computing Systems are necessary for the analysis of composite and large amounts of information, for functions that require complex computation, or for the extraction of quantifiable information. Moreover, the human visual cortex is an excellent image analysis tool, precisely for extracting comprehensivestatistics, and for many applications — including medicine, land categorization (forest, pastures, farming, grazing and draught land), security, and remote sensing — human analysts still cannot be replaced by computers. For this purpose, many important image analysis methods such as edge detectors and neural networks are motivated by human visual perception models.

In Figure 2 satellite views of different environments are captured.

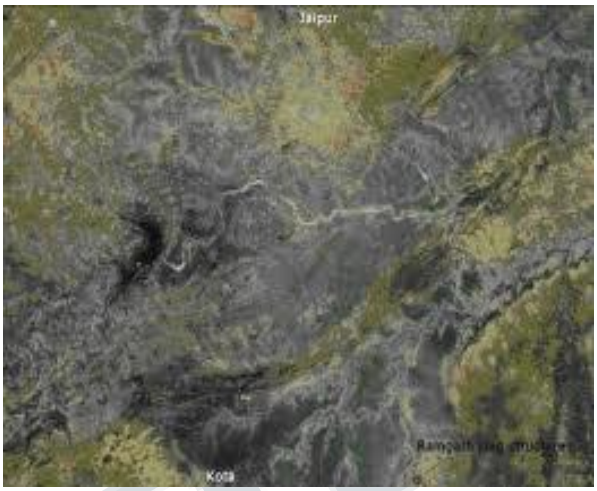

Fig.2 Satellite view

III. ANT COLONY ALGORITHM

Ant behavior was the motivation for the heuristic optimization technique.

In computing technology and operations research, the ant colony optimization algorithm (ACO) is a probabilistic/stochastic technique for solving computing problems which can be summarized to finding better paths through graphs [2].

Initially proposed by Marco Dorigoin 1992 in his PhD thesis, the first algorithm was directed to search for an optimal path in a graph, based on the behavior of ants searching a path between their colony and a source of food. The original idea has since differentiated to solve a comprehensive class of computational problems, and as anoutcome, several problems have emerged, illustration on various aspects of the behavior of ants [3].

In the real life, ants roam randomly, and upon finding food return to their colony while placing down pheromone trails. If other ants discover such a path, they are likely not to keep wandering at random, but to follow the trail, returning and reinforcing it if they eventually discoverthe food.

Figure 3 represents the path from ant colony to the food source.

Over time, the pheromone trail starts to evaporate, thus reducing its attractive aroma. The more time it takes for an ant to walk down the path and back home again, the extra time the pheromones have to evaporate. A short path, by comparison, gets walked over more repeatedly, and thus the pheromone density becomes developed on shorter paths than longer ones, hence shorter path are developed. Pheromone evaporation also has the enhancement of circumventing the convergence to a close by optimal result. Consider there were no evaporation to any extend, the paths preferred by the first ants would incline to be extremely attractive to the following ones. In that case, the investigation of the solution space would be constrained [9] [10].

Thus, when one ant finds a good path from the colony to a food source, other ants are more expected to follow the same path, and optimisticresponse eventually leads all the ants following a single path as shown in figure 4. The ant colony algorithm is the methodology to simulate this behavior with "simulated ants" walking around the graph representing the problem to solve [7] [8].

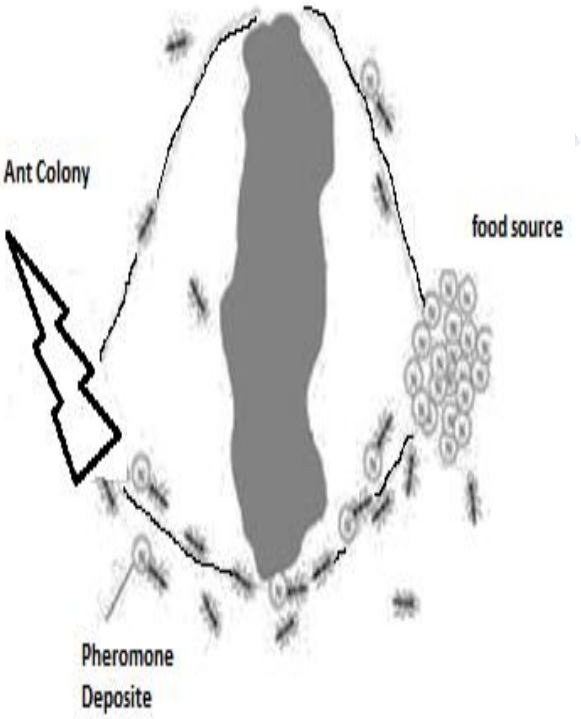

Fig. 3 Path from ant colony to food source.

A EDGE DETECTION

Edge detection is a fundamental methodology used in image processing, appliance vision and computational processing, particularly in the areas of attribute detection and feature extraction, which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The same problem of finding discontinuities in 1D signal is known as step detection [5] [6] [11].

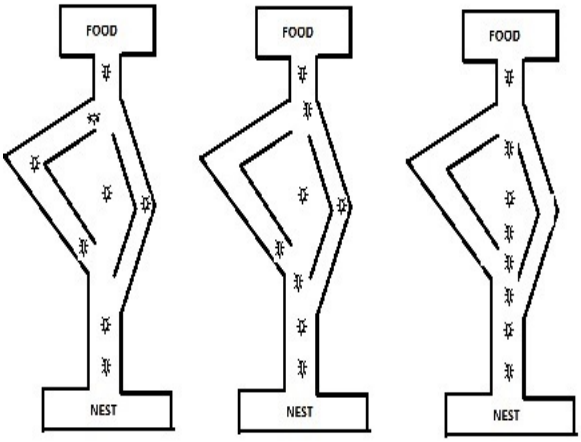

Fig.4 Edge detection

B CONVERGENCE

For some versions of the algorithm, it is feasible to prove that it is convergent (i.e. it is able to find the global optimum in finite time). The first conclusion of a convergence ant colony algorithm was made in 2000, the graph-based ant colony system algorithm, and then algorithms for ACS and MMAS [6]. Similarly, mostMetaheuristics, it is very challenging to estimate the theoretical speed of convergence. In 2004, Zlochin and his colleagues showed that COA-type algorithms could be integrated methods of stochastic gradient descent, with the cross-entropy and estimation of distribution algorithm. Zlochin and his colleagues proposed these Metaheuristics as a "research-based model". Stochastic optimization algorithm is random search[4].
In Figure5 the ACO metaheuristic behavior is implemented in pseudo-code. Themain procedure of the ACO metaheuristic manages, via the **Schedule Evens**construct, the scheduling of the three above discussed components of ACO algorithms:
(i) Management of ants' activity, (ii) pheromone evaporation [12].

Example pseudo-code by Marco Dorigo

procedure*ACO metaheuristic*
Schedule Events
Manage_Ants_Events()
Evaporate_Pheromone()
□
end Schedule Events_
end*ACO metaheuristic*

Fig.5 ACO metaheuristic.

Algorithm :

1. Start
2. Read Image.
3. Remove Noise.
4. Segmentation using an Ant Colony algorithm.
5. Edge detection.
6. Convergence
7. Classification of Images
8. Output images.
9. End

CONCLUSION

This paper presents a progression to provide an assistance to the Maharashtra government to increase the economic growth rate of the state. This method is based on image analysis using an ant colony algorithm.

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