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# Analytical Method of Multi-Objective Genetic Algorithm with Multi-Objective Messy Genetic Algorithm in Satellite Image Segmentation

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## ABSTRACT

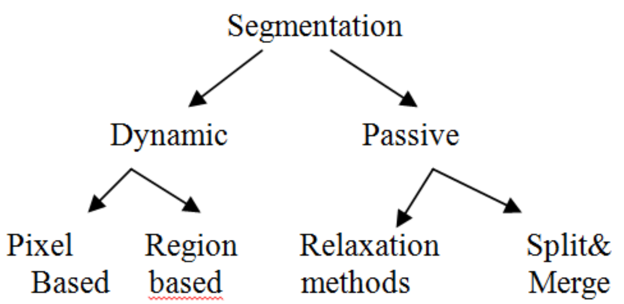
Image can be dividing into different Segmentation. In image processing , the important task is Segmentation process methods. This method involves such as K-means clustering, watershed segmentation, Fuzzy c-Means, Iterative Self Organizing Data. Clustering methods depends powerfully on the selection of the primary spectral signatures which represents initial cluster centers. Normally, this is either done physically or erratically based on statistical operations. In this case the outcome is random and sometime inaccurate. In base paper an unsupervised method based on Multi-Objective Genetic Algorithm (MO-GA) for the selection of spectral signature from satellite images is implemented. The goal is to make greatest cluster centers as an initial population for any segmentation technique. Experimental results are conducted using high-resolution SPOT V satellite image and the verification of the segmentation results is based on a very elevated resolution satellite image of kind Quickbird. The spectral signatures method to Fuzzy c-means and K-means by MO-GA method increased the speed of the clustering algorithm to approximately4 times the speed of the random based selection of signatures. In this paper unsupervised method is comparative with Multi-Objective Messy Genetic Algorithm(MOMGA) with existing MO-GA methods for the selection of spectral signature using satellite images.

**Keywords:** Multi-Objective Genetic Algorithm, Multi-Objective Messy Genetic Algorithm Clustering, Image Segmentations, Satellite Images.

## I. INTRODUCTION

Image segmentation process is to divide the image into homogeneous, self-consistent regions, which should correspond to different objects in the scene. The process is achieved using only properties of the image. The basic property useful for image segmentation is its amplitude. The other properties such as edges and texture are also useful for image segmentation. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to evaluate.[1] Image segmentation is generally used to set objects and boundaries as lines, curves, etc. in images.

It is classified in the following way as



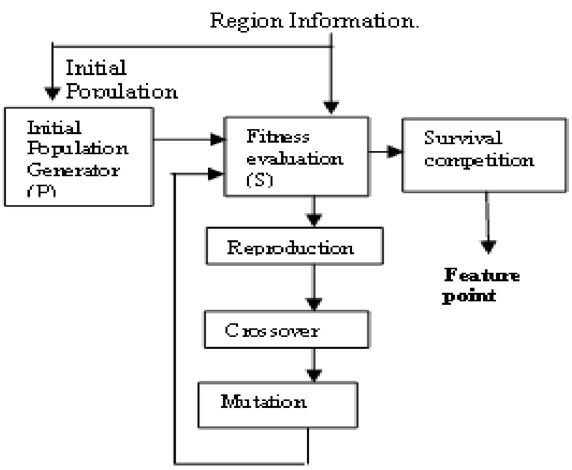
More exactly, image segmentation is the process of assigning a label to each pixel in an image such that pixels with the similar label divide certain visual characteristics. The most important clustering problem is unsupervised learning. This method involves such as clustering of K-means, watershed segmentation, FCM(Fuzzy c-Means), ISODATA (Iterative Self Organizing Data).

Clustering methods based strongly on the variety of the primary spectral signatures, which represents initial cluster centers. Normally, this is done either physically or erratically based on statistical operations.

Most remote sensing applications process digital images to extract spectral signatures at each pixel and use them to divide the image in groups of similar pixels (segmentation) using different approaches.[2]

## II. BLOCK DIAGRAM OF GA

They assign a class to each cluster (sorting) by comparing with recognized spectral signatures. A pixel in pixel resolution represent various spectral signature "mixed" together - that is why a great deal remote sensing analysis is done to "unmix mixtures". Eventually exact identical of spectral signature recorded by image pixel with spectral signature of existing elements leads to accurate classification in remote sensing.[2]




## III. MULTI OBJECTIVE GENETIC ALGORIHM (MOGA)

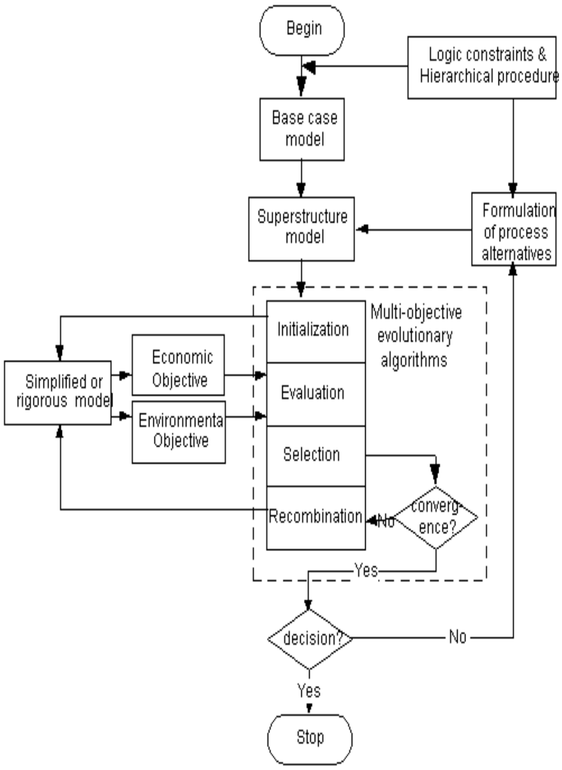
A multi-objective optimization problem can formally be stated as [3]: Find the vector v = [v1, v2, ..vn]T of choice variables which will assure a number of equality and inequality constraints and optimizes the follow vector task:

f(v) = [f1(v), f2(v),…,fk(v)](1)

The constraints classify the possible area F that contains all the allowable solutions. some solution exterior this area is not allowed since it violates one or more constraints. The vector v denotes an greatest solution in F. The idea of Pareto optimality is useful in the area of multi-objective optimization. A formal meaning of Pareto optimality from the view of the minimization problem may be given as follows: An result vector v is called Pareto optimal if and only if there is no v" that determines v, i.e. There is no v" such that

$$\forall i \in \{1,2,\ldots,k\}, f_i(v'') \leq f_i(v) \text{ and } \exists i \in \{1,2,\ldots,k\}, f_i(v'') < f_i(v)$$

In additional, v is Pareto optimal if there exists no feasible vector v" which causes a decrease on some criterion lacking a simultaneous increase in at least one other. In general, Pareto optimality naturally admits a set of solutions called non-dominated solutions. The numbers of multi-objective optimization techniques are accessible. Among them, the GA based techniques such MO-GA and MOMGA are accessed here.




2.1 Easy multi-objective genetic[MOGA] algorithm

In [4] is presented a genetic algorithm that will be used as a base for the implementation of the three different methods. The simplest completion of MOGA, but has proved to be efficient.

The technique progress as follow:

1. Randomly create an initial population of solution vectors.
2. Reproduction: two parents are randomly selected in the population and are crossed to obtain two children.
3. Replacement: the four solutions are sorted according to their rank, and the two best are kept in the population
4. Repeat the step 2 and 3 on the new population until a maximum number of computation is reached.

## IV. MULTI OBJECTIVE MESSY GENETIC ALGORITHM (MOMGA)

The MOMGA is an explicit structure block GA that produces all building blocks of a client particular range. This searching method is a limited model builder. Thus the design expands to the compressed genetic algorithm.

The MOMGA plainly uses these building blocks in grouping to effort to resolve for the best solutions in multi objective troubles. The unique messy GA consists of three different phases: Primordial Phase, Juxtapositional Phase and Initialization Phase. The MOMGA uses these concepts and extends them anywhere required to hold k > 1 objective functions. In the first phase, the MOMGA gives all building blocks of a user specified measure. In previous section performs event collection on the population and reduces the population size if needed. This size is adjusted based on the percentage of “high” fitness BBs that exist.

The templates of MOMGA are locally optimal, they are focused on portions of the search space. Thus will instantiating the several free MOMGA runs all solving the same MOP originally focuses exploration in different (and additional) portions of the explore space.

```
For n = 1 to k
  Perform Partially Enumerative Initialization
  Evaluate Each Population Member's Fitness (w.r.t. k Templates)
|| Primordial Phase
  For i = 1 to Maximum Number of Primordial Generations
    Perform Tournament Thresholding Selection
    If (Appropriate Number of Generations Accomplished)
      Then Reduce Population Size
    Endif
  End Loop
||Juxtapositional Phase
  For i = 1 to Maximum Number of Juxtapositional Generations
    Cut-and-Splice
    Evaluate Each Population Member's Fitness (w.r.t. k Templates)
    Perform Tournament Thresholding Selection and Fitness Sharing
    P_known(t) = P_current(t) ∪ P_known(t − 1)
  End Loop
Update k Competitive Templates (Using Best Value Known in Each Objective)
End Loop
```

It also defined as the proportion of speedup to the number of processors. These computational act metrics are then teamed with suitable algorithmic presentation events to decide overall MOMGA performance.

The population growth as the building block size grows can be the drawback of this approach in a few applications.

3.1 Easy multi-objective messy genetic [MOMGA] algorithm

1. Initialize the parameters of the unit commitment problem.
2. Set the sample image as 24-bit units.
3. Input the number of units.
4. Regarding to the problem constraint set the cost function, which is to be minised.
5. Initialize the messy genetic algorithm and determine the appropriate template values.
6. Enter the value of MGA.

Its a] produce an initial population

7. Enter the juxtapositional phase.

b]apply the operations

c]evaluate the sample image

8.Output the statistics.

## V. COMPARISON

The proposed algorithm is evaluated image from two different satellites are used. Images like SPOT V and Quickbird images are functional here . SPOT V image offers a declaration of 2.5 to 5 meters in panchromatic methods and 10 meters in multi-spectral way. The Quickbird satellite image having 2.4 meter resolution with four multi-spectral bands and one panchromatic band with0.61 meter resolution. The results of the new signature selection algorithm are passed to K-means algorithm [5-7] and Fuzzy c-means [8-9] to complete the clustering process. K-means follows a simple method for classifying a specified data set using a predefined number of k clusters. The number of clusters is determined by the complete spectral signatures which are obtained by the multi-objective genetic algorithm. FCM (Fuzzy c-means) is a technique of clustering which allows one piece of data to belong to two or more clusters. This technique is commonly used in pattern recognition. This is based on minimization of a separate objective task.

## VI. ALGORITHM IMPLEMENTATION

Initially decided on the population size and the number of generations. Usually, the collection of these parameters strongly depends on the size of the image. An imperative of thumb rule, if the size of image are ordered into four categories (a very large image is an image having a size greater than 2048´2048 pixels, large image is an image between 512´512 and 2048´2048 pixels, a average is involving 128´128 and 512´512 pixels and lastly small one is less than128´128 pixels) then the population size and the chromosome length increases 30 individuals and 4 genes for each increment of 128´128 pixels[10]. It is preferable to start with a population of size 20 and entity length of 8 genes (every represents 4 coordinates) for tiny image[10]. The mutation charge is various between 5% and 10% while crossover rate is various connecting 60% and 80%. The amount of population is set to be 100 and character length is 96[10].

In the following images shown as Spot V and Quickbird by comparison of Multi objective genetic algorithm[MOGA] and multi objective messy genetic algorithm[MOMGA].

The fig 1(a) and figure 2(a) represents a MOGA with less clarity of images , it could not display the clear pixels. But figure 1(b) and figure 2(b) displays an image segmentation with more accuracy and it can able to get the more selection methods.

Figure 1(a)

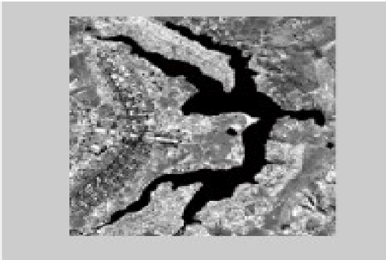


Figure 1(b)

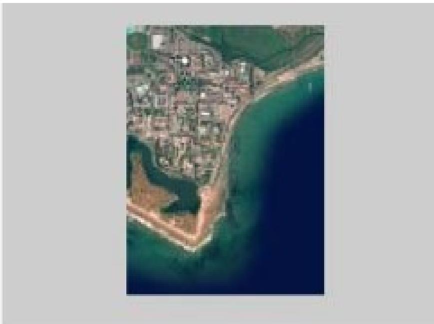


Figure 2(a)

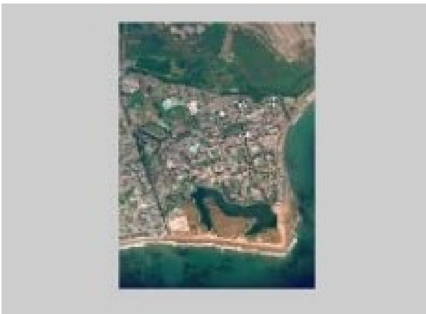


Figure 2(b)

The total figure of the samples in the by the total number of all samples indicates the percentage of accuracy. The four classes of segmented image is used for the verification process of MO-GA is based on signature selection method. The accuracy is calculated by new selection technique is more than 95% (Fuzzy K and c-means based on MO-GA). The accuracy of process is less than or equal to 85%.

## VII. CONCLUSIONS

The multi-objective Genetic Algorithm (MO-GA) and multi-objective messy Genetic Algorithm (MOMGA) is used to generate a strong and efficient spectral signature selection technique. The explanation consists of many individuals each is a promising collection of spectral signatures which can be used with any segmentation/classification algorithm such as K-means and Fuzzy c-means. In this selection technique the application of Spot V satellite image and QuickBird satellite image results giving high resolution. The selection tool is four times faster to the traditional cluster methods. The cluster centers by Fuzzy c-means and K-means with number of iterations as the MO-GA. The results is giving more accuracy compared with old technique , Finally conclude MOMGA is a improving MOGA method given image segmentation is more accurate.
In the future these techniques will applied to applications of real-world problems and many issues left to be solved with more accurate from selection methods. In the future MOMGA method used in different geometric shapes like octagon, hexagon, non-uniform shapes, etc.

The selection method gives more accurate with time consuming of old technique.

## VIII. REFERENCES

[1]. R. Demirci, Rule-based automatic segmentation of color images. International Journal of Electronics and Communication60,435.
[2]. K. Deb, Multi-objective Optimization Using Evolutionary Algorithms. (John Wiley and Sons, England).
[3]. https://www.google.co.in/search?q=spot+v+satellite+image&source=lnms&sa=X&ei=u7SeUpbWL83YkQXW4ICwAQ&ved=0CAYQ_AUoAA&biw=1366&bih=629&dpr=1#q=spectural+signature++in+image+processing+-+wiki.

[4]. http://epbysique.ulb.ac.be/IMG/pdf/devooght_2011.pdf
[5]. J.MacQueen, Some Methods for classification and Analysis of Multivariate Observations, In Abstracts of 5-th Berkeley Symposium on Mathematical Statistics and Probability 1,Berkeley,
[6]. R. Duda, P. Hart, and D. Stork D, Pattern Classification, Second Edition. (JohnWiley& Sons, New Jersey, 2000)
[7]. J.Tou and R.Gonzalez, Pattern RecognitionPrinciples.( Addison-Wesley,).
[8]. J. Dunn, A Fuzzy Relative of the ISODATA Process and Its Use in Detecting Compact Well-Separated Clusters, Journal of Cybernetics 3, pp..
[9]. J. Bezdek, Pattern Recognition with Fuzzy Objective Function Algoritms, (Plenum Press, New York,.