

# A REVIEW: MIXED PIXEL RESOLUTION BY OPTIMIZATION ALGORITHM

1) **Er. Mittu Mittal** (Mtech, CSE)  
Department of CSE, RIMT Institutions  
Mandi Gobindgarh, Punjab, India  
[Mittu231188@yahoo.co.in](mailto:Mittu231188@yahoo.co.in)

2) **Er. Gagandeep** (A.P, CSE)  
Department of CSE, RIMT Institutions,  
Mandi Gobindgarh, Punjab, India  
[gaganarora9@gmail.com](mailto:gaganarora9@gmail.com)

3) **Er. Jagmeet Bawa** (Mtech, M. E)  
UCOE, Punjabi University, Patiala  
[jagmeetguraya@yahoo.in](mailto:jagmeetguraya@yahoo.in)

4) **Er. Ashish Mittal** (Mtech, E& C)  
Amity University, Noida  
[Mittal\\_123ash@yahoo.com](mailto:Mittal_123ash@yahoo.com)

**ABSTRACT:** Now a day's Remote Sensing is a mature research area. Remote sensing is defined as a technique for acquiring the information about an object without making physical contact with that image via remote sensors. But the major problem of remotely sensed images is mixed pixel which always degrades the image quality. Mixed pixels are usually the biggest reason for degrading the success in image classification and object recognition. Another major problem is the decomposition of mixed pixels precisely and effectively. Remote sensing data is widely used for the classification of types of features such as vegetation, water body etc but the problem occurs in tagging appropriate class to mixed pixels. In this paper we attempted to present an approach for resolving the mixed pixels by using optimization algorithm i.e. Biogeography based optimization. The main idea is to tag the mixed pixel to a particular class by finding the best suitable class for it using the BBO parameters i.e. Migration and Mutation.

**KEYWORDS:** Remote Sensing, Mixed pixel, Biogeography based optimization, Migration, Mutation, Evolutionary algorithms.

## 1 INTRODUCTION TO REMOTE SENSING

Remote sensing is the practice of deriving information about the earth's land and water surfaces using images acquired from an overhead perspective, using electromagnetic radiation in one or more regions of the electromagnetic spectrum, reflected or emitted from the earth's surface. This definition certainly does not cover all areas (e.g. meteorological or terrestrial remote sensing), it does serve well as a description of remote sensing. Remote sensing makes use of electromagnetic radiation. The strongest and best-known source of electromagnetic radiation is our sun, which emits radiation over the entire electromagnetic spectrum see fig 1. Besides this natural source of illumination, which is used for passive remote sensing, it is also possible to use an artificial source of electromagnetic radiation, in which case we speak of active remote sensing.

Remote sensing can be defined as the collection of data about an object from a distance. Humans and many other types of animals accomplish this task with aid of eyes or by the sense of smell or hearing. Geographers use the technique of remote sensing to monitor or measure phenomena found in the Earth's lithosphere, biosphere etc. Remote sensing of the environment by geographers is usually done with the help of mechanical devices known as remote sensors. These gadgets have a greatly improved ability to receive and record information about an object without any physical contact. Often, these

Sensors are positioned away from the object of interest by using helicopters, planes, and satellites. Remote sensing imagery has many applications in mapping land-use and cover, agriculture, soils mapping, forestry, city planning, archaeological investigations, military observation, and geomorphologic surveying, among other uses. For example, foresters use aerial photographs for preparing forest cover maps, locating possible access roads, and measuring quantities of trees harvested. Specialized photography using color infrared film has also been used to detect disease and insect damage in forest trees.

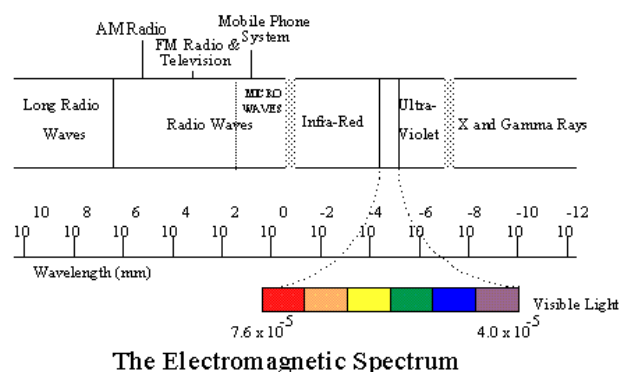


Fig 1: Principal divisions of the electromagnetic spectrum

Remote sensing map takes pixel as a measurement unit in the ground detection. Since the limited

precision of satellite remote sensing detection, sometimes there are several kinds of ground objects in the range of one pixel, which is named mixed pixel. On the contrary, the pixel that consists of one kind of ground object is described as typical pixel. Generally the spectrum features of different ground objects are different. The spectrum of mixed pixels is a mixture of poly-type spectrum of ground objects according to some proportion. The existence of mixed pixel is one of the main factors that affect classifying precision in image recognition. Especially it affects the classification and recognition of linear ground objects and petty ground objects. A lot of mixed pixels are bound to appear at the edge of ground objects. The key to resolve the problem is to find out the Proportion of different objects.

#### **There are various methods for the decomposition of mixed pixel as follows**

1. linear discriminate analysis
2. probabilistic, geometric-optical
3. stochastic geometric
4. fuzzy
5. Artificial Neural Network models
6. Evolutionary algorithms

All of the above mentioned methods are traditional. But evolutionary algorithms are new approach for resolving mixed pixel problem of remote sensing images.

## **2 BIOGEOGRAPHY BASED OPTIMIZATION**

Biogeography is the study of the distribution of biodiversity spatially and temporally. Over real ecological changes, it is also tied to the concepts of species. Immigration is the introduction of new people into a habitat or population. It is a biological concept and is important in population ecology. A habitat (which is Latin for "it inhabits") is an ecological or environmental area that is inhabited by a particular species of animal, plant or other type of organism. It is the natural environment in which an organism lives, or the physical environment that surrounds (influences and is utilized by) a species population. Biogeography unfolds the geographical distribution of biological organisms. Their interest was primarily focused on the distribution of species among neighboring islands. The application of biogeography to engineering is similar to what has occurred in the past few decades with genetic algorithms (GAs), neural networks, fuzzy logic,

particle swarm optimization (PSO), and other areas of computer intelligence. The term "island" here is used descriptively rather than literally. That is, an island is any habitat that is geographically isolated from other habitats. We therefore use the more generic term "habitat" in this paper (rather than "island"). Geographical areas that are well suited as residences for biological species are said to have a high habitat suitability index (HSI). Features that correlate with HSI include such factors as rainfall, diversity of vegetation, diversity of topographic features, land area, and temperature. The variables that characterize habitability are called suitability index Variables (SIVs). SIVs can be considered the independent variables of the habitat, and HSI can be considered the dependent variable. Habitats with a high HSI have many species that emigrate to nearby habitats, simply by virtue of the large number of species that they host. We call this approach to problem solving biogeography-based optimization (BBO).

### **2.1 MIXED PIXEL PROBLEM**

The importance and impact of spatial resolution is also witnessed by the mixed pixel 'problem'. Mixed pixels, sometimes known as 'mixels', occur where the image pixels are not homogenous, or 'pure'. Instead a pixel contains a measure of the energy reflected or emitted from several different materials or land surface objects and the sensor records a composite of these responses (Fig 2).

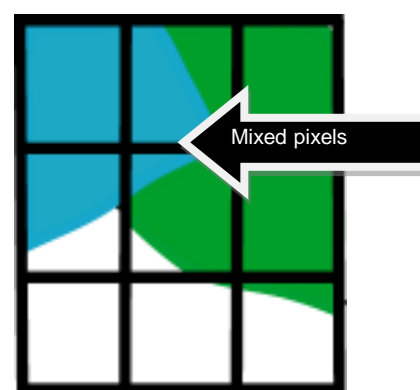


Fig 2: The mixed pixel problem. Many of the pixels in this 9 cell grid contain more than one class.

In many cases this spectral mixing can make it very difficult for the image analyst to identify the different sub-pixel fractional components that serve to make up the landscape under observation. Under these circumstances the analyst may wish to employ a finer resolution data set, in order that a greater number of 'pure' pixels may be recorded. Even with very fine resolution, however, there is still the issue of edge

pixels, where pixels can show the boundaries between different land surface properties. Land surface features do not follow the arbitrary confines of the pixel and therefore even very fine spatial resolution data of the order of a few meters' will still experience some degree of confusion and spectral missing.

As you can imagine, mixed pixels can cause great difficulties in the stages of image analysis and interpretation. One of the common tasks in this process is image classification. Classification is widely used as it allows users to easily discriminate information from images presented as a series of categories (classes) rather than raw digital number (DN) values. Images are classified on the basis of their spectral properties. Each pixel of remote sensing image contains the information from multifarious ground objects due to the difference from the resolution of remote sensing image, called **Mixed pixel**.

**There are three main causes for mixing pixels in any remotely sensed image which are listed below:-**

- Mixed caused by the presence of small, sub pixel targets within the area it represents (Fig 3)



Fig 3: Mixed pixel

- Mixing as a result of the pixel straddling the boundary of discrete thematic classes (Fig 4)



Fig 4: Mixed pixel

- Mixing due to gradual transition observed between continuous thematic classes.

To resolve these problems we proposed a new methodology using BBO algorithm which is described in next section.

### 3 METHODOLOGY & RESULT

**INPUT:** Data set of pure and mixed pixels

- Read an image and identify the data set of pure and mixed pixels.
- Clustering is done on the basis of color intensity, texture etc.
- Initially choose a set of pure pixels and calculate the best pixel value using G.A.
- Now calculate HSI of each of the Habitat.
- Take one class of mixed pixel and transfer each of corresponding mixed pixel to both the Habitats to which it belongs i.e. Immigration & Emigration.
- Recalculate the HSI of those two Habitats. If recalculated HIS (A) < HIS (B) then absorb the mixed pixel in feature A otherwise in feature B.
- Repeat till all the mixed pixels of class taken are resolved.

**OUTPUT:** All mixed pixels are classified

### 4 CONCLUSION & FUTURE SCOPE

Mixed pixel resolution is a big problem in any remotely sensed imaging. Thus our method can resolve greater number of mixed pixels problem in effective way and also helpful in providing great accuracy in output images. Future work could focus on combining BBO with other EAs like PSO, ABC etc to resolve the problem of mixed pixel resolution.

### ACKNOWLEDGEMENT

This study was supported by the Department of computer science & Engineering of RIMT Institutes Near Floating Restaurant, Sirhind Side, Mandi Gobindgarh-147301, and Punjab, India.

### REFERENCES

- [1] Suruchi Sinha, Abhishek Bhola, V.K.Panchal, Siddhant Singhal and Ajith Abraham, "Resolving Mixed Pixels by Hybridization of Biogeography Based Optimization and Ant Colony Optimization", "WCCI 2012 IEEE World Congress on Computational Intelligence June, 10-15, 2012 - Brisbane, Australia".

- [2] V.K.Panchal and Nitish Gupta. "Swarm Intelligence For Mixed Pixel Resolution", "IEEE Geo Sciences and Remote Sensing Symposium (IGRASS), pp- 2801-2804, 2011".  
for Remote Sensing Jacky Desachy Rome, Italy | September 26, 2012".
- [4] A. L. Choodarathnakara, Dr. T. Ashok Kumar, Dr. Shivaprakash Koliwad, Dr. C. G. Patil , " Mixed Pixels: A Challenge in Remote Sensing Data Classification for Improving Performance" , "International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 1, Issue 9, November 2012".
- [5] Lavika Goel, Daya Gupta, Vinod Panchal , " Extended Species Abundance Models of Biogeography Based Optimization" , " 2012 Fourth International Conference on Computational Intelligence, Modelling and Simulation. 2166-8531/12 \$26.00 © 2012 IEEE DOI 10.1109/CIMSim.2012.30".
- [6] Haiping Ma, Minrui Fei, Zhiguo Ding, Jing Jin," Biogeography-Based Optimization with Ensemble of Migration Models for Global Numerical Optimization" , "WCCI 2012 IEEE World Congress on Computational Intelligence June, 10-15, 2012 - Brisbane, Australia".
- [7] Alaa Sheta, Malik S. Braik, Sultan Aljahdali , " Genetic Algorithms: A Tool for Image Segmentation" , " The World Islamic Science and Education (WISE) University, Amman, Jordan 978-1-4673-1520-3/12/\$31.00 ©2012 IEEE".
- [8] Dan Simon, *Senior Member, IEEE*, Mehmet Ergezer, *Member, IEEE*, Dawei Du, and Rick Rarick , "Markov Models for

- [3] P. Bosdogianni ; Maria Petrou ; Josef Kittler , " Mixed pixel classification in remote sensing" , " Image and Signal Processing Biogeography-Based Optimization" , " IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS—PART B: CYBERNETICS, VOL. 41, and NO. 1, FEBRUARY 2011".
- [9] D. Simon, "Biogeography-based optimization," *IEEE Trans. Evol. Comput.*, vol. 12, no. 6, pp. 702–713, Dec. 2008.
- [10] Haiping Ma, Suhong Ni, and Man Sun , " Equilibrium Species Counts and Migration Model Tradeoffs for Biogeography-Based Optimization" , "Joint 48th IEEE Conference on Decision and Control and 28th Chinese Control Conference Shanghai, P.R. China, December 16-18, 2009".
- [11] Binitha S, S Siva Sathya , " A Survey of Bio inspired Optimization Algorithms", " : International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-2, Issue-2, May 2012".
- [12] Anita Thengade , Rucha Dondal, "Genetic Algorithm - Survey Paper", " IJCA Journal 2012".
- [13] Purshottam J. Assudani, Latesh G. Malik , " Genetic Algorithm Based Dot Pattern Image Processing", "IJCA Journal 2012".