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Satellite Image Classification Based on Natural Computing Algorithms: A Survey

[1]Er. Priya Gautam, [2]Er Harish Kundra
[1]M.Tech Student,[2]Head of Department
Department of Computer Sc.&Engg, Rayat College Of Engg. & IT, Ropar, Punjab, India
[1]gautam.priya9@gmail.com,[2]hodcseit@rayatbahra.com

Abstract: *A Satellite image classification is a significant method used in remote sensing for the automated analysis and pattern recognition of satellite data, which facilitate the automated understanding of a large amount of information. These days, there exist many types of classification algorithms, such as parallelepiped and minimum distance classifiers, but it is still essential to get better their performance in terms of correctness rate. On the additional hand, in excess of the last few decades, cellular automata have been used in remote sensing to implement procedure related to simulation. While there is little preceding research of cellular automata related to satellite image classification, they offer much reward that can improve the results of classical categorization algorithms. This document discuss the expansion of a new organization algorithm based on cellular automata which not only improve the classification accuracy rate in dependency images by using related techniques but also offers a hierarchical classification of pixels divided into levels of association degree to each class and includes a spatial edge discovery method of classes in the satellite image.*

Keywords: *Image categorization, Pattern identification, Distant (Remote) sensing.*

I. INTRODUCTION

A Remote sensing has been used in numerous ecological applications with the plan of solve and getting better all sorts of problems: dirt class studies, water reserve research, meteorology simulation, and environmental protection, among others [1]. To resolve all of these problems, one must bring together and process huge amounts of satellite data, which create one of the hardest problems facing remote sensing [2].Among all of the techniques used in remote sensing to help forecaster expert understand the data gathered, categorization algorithms are the most practical and able. These classification algorithms for satellite images group together image pixels into a limited number of classes, which helps in interpret a great deal of data controlled in the spectral bands [3]. When applying a classification algorithm to a dependency image, the data obtain by the satellite sensors as digital levels are altered into a categorical scale that is easily interpret by analyst experts. The resultant classified image is a thematic map of the unique satellite image, and pixels belong to the same class split alike spectral character.

II. IMAGE CLASSIFICATION

Image organization is a major part of the isolated sense, image examination with example recognition. In several occurrences, the classification itself may be the object of the revise In support of instance; institute property uses from slightly intellect data make a graph like image as the last manufacture of the study. The image foundation so form a significant tool for appraisal of the digital imagery [4]. The word classifier refers listlessly to a CPU agenda that tools a definite process for image categorization. The predictor has got to choose a cataloging development that will best total a precise task. At there, it is not possible to condition which classifier is best for all condition as the feature of each likeness and the state for each study vary so in reality. As a result, it is essential that each predictor be satisfied about the option plan for picture category so that he or she strength is ready to select the fit classifier for the duty in hand.

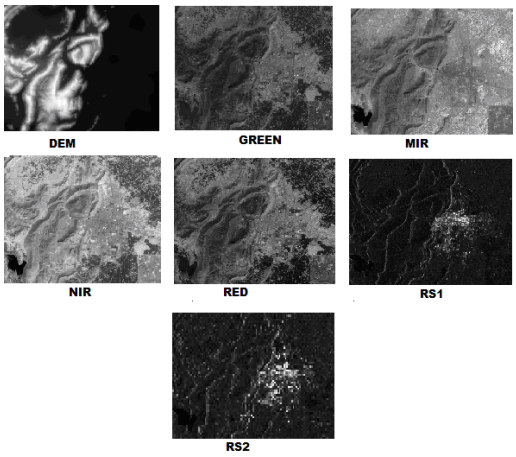

Figure.1 Image classification of Alwar taken from satellite

Image categorization method in Remote Sensing:

- Unsubstantiated image classification
- Supervise image classification
- Purpose based image analysis

According to this document, base on the user's investigation, the data are group. The greater part of the obtainable text classification algorithm is lacking of this resemblance index, in the planned paper two categorization algorithms will be describe called SVM and GA algorithm.

III. RELATED WORK

Vinit Kumar et.al [10] current an original go forward to categorize an image with the prospect notion of babe bees. This paper focuses on the likelihood occurrence of darling beef to select their nectar quality. On that basis we will classified our representation things.

L De Casro [2006]: [11] author presented basic fundamentals algorithms and various applications of natural computing.

Lila Kari, Grzegorz Rozenberg [2010] : [12] reviews the lots of facet of ordinary Computing such as cellular automata, neural network, genetic algorithm, swarm intelligence, membrane computing, intelligent water drop, firefly algorithm, Bee dependency Optimization, biogeography based optimization, particle swarm optimization, cuckoo search.

Harish Kundra et.al [13] relates a group brains based hybrid algorithm of Cuckoo Search and ACO to perform the satellite picture categorization. Although together are Meta heuristic bio enthused procedure, but motionless combine those give a immense collision particularly in the request field of remote sense. The main pro of using the hybridization notion is that the search strategy conduct by CS is replace by the direct best path originate by the Ant Colony Optimization algorithm for the best host nest necessary by cuckoo egg. The consequences wrought by the mixture algorithm are contrast with the consequence obtain by other swarm intellect based cross algorithm ACO/BBO, ACO/SOFM, ABC/BBO, and FPAB/BBO to show the confirmation of our planned hybrid algorithm. The examination of mixture algorithm is performance by classify a multi haunted, high announcement satellite representation of Alwar section.

Akansha et.al [14] applying a Meta heuristic approach called Cuckoo Search in the area of image classification. The main advantage of this algorithm over other Meta heuristic approach is that its search space is extensive in nature. The proposed methodology is applied to the Alwar region of Rajasthan. The picture worn is a 7 group image of 472 X 546 dimensions from Indian Remote Sensing Satellite Resiurcesat. This algorithm has captured almost all the terrain features and showed high degree of efficiency for almost all the regions (water, vegetation, urban, rocky, and barren) with a Kappa coefficient of 0.9465.

Lovika Goel et.al [15] available a dynamic replica of the blend biogeography base optimization (BBO) for land cover feature extraction. In the blend BBO, the habitats represent the candidate problem solution and the species transfer represents the sharing of features among applicant solution according to the vigor of the habitat which is called their HSI value. Though, it is not mentioned that these SIVs i.e. the number of solution facial look, stay steady for every habitat and the HSI for each occupancy depends only on the movement and the migration rates of class. This paper extend the blend BBO by considering the fact that the no. of SIVs or the decision variables may not continue stable for all applicant solutions that are part of the worldwide habitat. Since the individuality of each habitat vary greatly hence, compare all the habitats using the same set of SIVs may be deceptive and also may not lead to a most favorable solution. Hence, in our lively model, we think the in order that HSI of answer is flashy by issue other than transfer of SIVs i.e. explanation facial look, also. These other factors can be modeled as quite a few definitions of HSI of a home, each definition based on a different set of SIVs which suggest the effect of this additional issue. We make obvious the presentation of the proposed model by running it on the real world problem of land cover feature removal in a multi spectral resolution image. The planned algorithm has a generally competence of 0.68812.

Arpita Sharma et.al [16] proposed two novel nature enthused decision level fusion techniques, Cuckoo Search Decision Fusion (CSDF) and Improved Cuckoo Search Decision Fusion (ICSDF) for enhanced and refined extraction of terrain features from remote

sensing data. The developed techniques derive their basis from a recently introduced bio-inspired meta-heuristic Cuckoo Search and modify it suitably to be used as a fusion technique. The algorithms are validated on remote sensing satellite images acquired by multispectral sensors namely LISS3 antenna image of Alwar region in Rajasthan, India and LANDSAT Sensor image of Delhi region, India. Overall accuracies obtained are substantially better than those of the four individual terrain classifiers used for fusion. Results are also compared with majority voting and average weighing policy fusion strategies. A notable achievement of the proposed fusion techniques is that the two difficult to identify terrains namely barren and urban are identified with similar high accuracies as other well identified land cover types, which was not possible by single analyzers.

IV. REMOTE SENSING IMAGES

There are various types of remote sensing images, which are as follows:

- **Multispectral Image**

A multispectral image consists of several bands of data. The bands in multispectral image are less than 30.This depends on the application and it is always less than 30 bands [7].

- **Super spectral Image**

Current satellite sensors are competent of capture images at many more wavelength bands [8]. For example, quite a few satellites consist of 36 spectral bands; cover the wavelength regions ranging from the visible, near infrared,
Shortwave infrared to the thermal infrared. Bandwidth of the bands is narrower, allowing the larger spectral individuality of the target to be seized by the sensor. The words "super spectral" refer such sensors.

- **Overexcited spectral Image**

An overexcited spectral image consists of hundred or more contiguous spectral bands form a three dimensional (two spatial dimensions and one spectral dimension) image cube. Dimensionality decrease has been widely used in agitated spectral image analysis to reduce data volume and idleness [9].

V. NATURAL COMPUTING ALGORITHMS

GENETIC ALGORITHM

Genetic Algorithms is search algorithms based on usual heredity that give robust search ability in comprehensive spaces. GA maintains a population of potential solutions of the applicant trouble termed as persons [6]. Treatment of these Individuals through genetic operator such as assortment, intersect and alteration, GA evolves towards better solution over a number of generation. Conclusion of a genetic algorithm is shown in flowchart in Fig below.

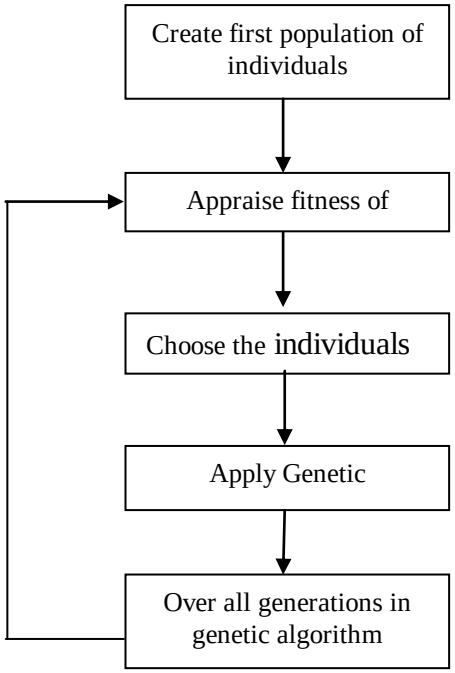

Figure.2 Genetic Algorithm Process

PARTICLE SWARM OPTIMIZATION

The section group Optimization algorithm (describe in [1]) is a biologically inspired algorithm stimulated by a community analogy. Now and then it is related to the Evolutionary calculation method, essentially with Genetic Algorithms and Evolutionary strategy, but there is important difference with those techniques.The PSO algorithm is population base: a locate of possible a solution evolves to move towards a convenient resolution (or set of solution) for a predicament. Creature an optimization scheme, the aim is finding the worldwide best likely of a real valued function (health function) separate in a given room (search space).

ANT COLONY OPTIMIZATION

The necessary standard of ant routing algorithm is with the intention of ants set down on the position a hormone, the pheromone, whereas they roam look for foodstuff. Ants can also stink pheromone and tend to go after with advanced chance those paths distinguish by strong pheromone concentration. The pheromone trails allow the ants to find their way to the food source (or back to the nest).

The similar pheromone follow can be second hand by other ants to discover the location of the food sources exposed by their nest mates. It was established

experimentally that this pheromone trail next recital gives raise to the manifestation of the shortest path.
An ant routing algorithm can be temporarily described in the follow way in Fig.3.

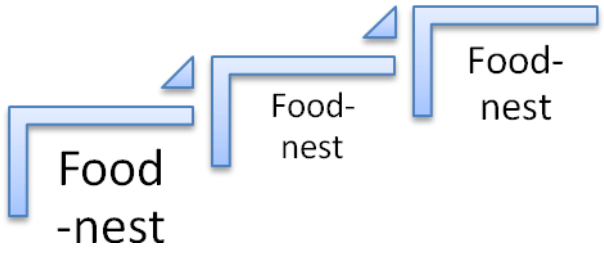

Figure 3: ACO Process

VI. CONCLUSION AND FUTURE SCOPE

In spite of being an age mature problem, image classification relic's active fields of interdisciplinary investigate till date. No single algorithm is known, which can group all real world datasets competently and without error. To moderator the excellence of an image classification from images taken from satellite, we need some specially designed statistical-mathematical algorithm.
They catalogs information, according to a prearranged classification or association such as shade, mass and so resting on, so they can be used for image classification in prospect.

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