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Object Based Analysis of Remote Sensing Images

Swasti Patel[1], and Dr. Priya Swaminarayan[2]

[1]Ph.D scholar, Department of Computer Engineering, Parul Institute of Engineering and Technology, Parul University, Vadodara, Gujrat, India
[2]Ph.D scholar, Department of Computer Engineering, Parul Institute of Computer Application, Parul University, Vadodara, Gujrat, India

Correspondence should be addressed to Swasti Patel; swastiwala16@gmail.com

ABSTRACT: Remote sensing is the process of detecting and identifying a region's physical properties by assessing reflected but also transmitted radiation from a range. Analog pictures include aerial photography, whereas digital images include satellite images taken using electronic sensors. A digital picture is made up of pixels that are arranged in a two-dimensional array. Pixel-based categorization algorithms were less successful as spatial resolution increased, since the connection among pixel size as well as the dimension of observable elements on the Planet's surface altered dramatically. In this paper the author discussed about image analysis based on objects and also characterized OBIA and GOBIA formation and its analysis. The chief objective of this paper is to gives a brief overview the technology that has been proved very efficient in analyzing the satellite (VHR) images. The study's future scope is as follows: The globe has seen extraordinary and quick progress in the fields of remote sensing, geospatial data collecting, and mapping during the previous several decades. The technology is gaining traction in terms of its use and application in several sectors.

KEYWORDS: Image processing, Image Analysis, Landsat, Objects, OBIA and GEOBIA, Remote Sensing.

I. INTRODUCTION

Aerial footage began in 1858 with Nadar's balloon-based images of Paris, France, as well as commercial space-borne remote sensing (RS) began in 1972 with Landsat-I. Since the late 1990s, this "pixel-centric" paradigm or "per-pixel techniques" has been called into doubt[1]. This system, it is claimed, does not make utilization of any spatial conceptions [2]. Particularly with high-resolution pictures, it's feasible that neighboring pixels belonging to distinct classes may nonetheless identify pixels relating to the same category[3]. GEOBIA (Geographic Object-Based Image Analysis) is now a hot topic in both remote sensing and geographical analysis. Its purpose is to develop automated methods for separating remote sensing (RS) photos into recognizable image objects as well as evaluating their features using geographic, spectral, textural, and temporal aspects, resulting in new geospatial information in a GIS-ready format.

Digital object-based categorization on the other hand, arranges pixels based on shared structural properties, and then assigns these classed segments to appropriate groups based on different sorts of attributes [4]. As a result, object-based classification is an approach that incorporates both visual as well as pixel-based categorization [4]. The second section outlines the move from pixel-based satellite image analysis to an object-based strategy, as well as some reasons for why object-based assessment is preferable for processing Very High-Resolution Images (VHR). The third chapter describes the survey done on the related subject. Environmental monitoring needs, ecosystem-oriented, conservation aims, spatial planning enforcement and natural resource management, to mention a few factors, create the improvement of functional frameworks that can extricate significant data from remote detecting information a high need[5]. The Landsat and SPOT satellites, as well as the ASTER and MODIS sensors, have become fundamental in provincial and worldwide investigations of biodiversity, natural life preservation, food security, deforestation impact, and desertification observing, among other application disciplines[6]. With the developing spatial goal of the '1-m age' of IKONOS (delivered in 1999), Quick Bird (2001), or Orb View (2003) sensors, satellite remote detecting may now deal with new application spaces that were already the domain of airplane remote detecting. In late 2007, the principal business satellites with a goal of not exactly a large portion of a meter (Worldview-1; 0.44 m panchromatic) went live, and security applications, car recognition, and a huge number of other metropolitan applications are for the most part filling in amount and intricacy. Peoples can distinguish two significant trends based on simplification and generalization: a growing volumes of information generated in an ever wider variety of radiometric, spatial, spectral, as well as temporal resolutions, such as the high spatial goals referred to above, yet in addition coordinated supranational frameworks and cycles for regular or on-request reviews of the world's surface.In the framework of the GMES, monitoring systems must be capable of translating complicated scene material into ready-to-use data. No matter what the application business, progresses in include ID and refined picture examination techniques make it more straightforward to remove topical data for strategy support and informed decisions. The availability of such data, as well as the growing utilization geoformation for sustainability economic growth and environmental protection, has sparked the development of new approaches to more effectively and target-oriented utilize picture information. Global commitments, directives, and regulations, with their strong need for rapid, accurate, and conditioned geospatial information, necessitate a practical response to an ever-increasing volume of data acquired from diverse monitoring systems. It is self-evident, but sometimes not consciously considered, that as sensor technology improves, a technically and geographically competent user community demands increasingly complex geo-spatial goods and communicates their wants correspondingly. It seems that as people become more aware of current issues, the need for focused information will double. The remotely sensed community is under pressure to respond and deliver. When industry focuses largely on sensor advancements, the efforts made to evaluate this data and derive extra value from them can scarcely be emphasized enough.

The act of distinguishing and observing a region's actual elements by estimating its reflected as well as produced radiation from a good ways is known as remote detecting. The principle objective of this paper is to gives a short outline the innovation that has been demonstrated exceptionally proficient in examining the satellite (VHR) pictures. Furthermore in second part the reviews of an authors are discussed and after that in discussion part the author discussed about image analysis based on objects and also characterized OBIA and GOBIA formation and its analysis.

II. LITERATURE REVIEW

H. Y. Gu a, H.T. Li, L. Yan, X.J. Lu et al. He gave a thought of a Geographic Object-Based Image structure in light of a philosophy. A contextual investigation of farmland was led. This structure could be exceptionally useful in giving understanding. First the geographic substance is thought about and its model is construct which is a semantic organization model. Next the article put together characterization is performed with respect to different sectioned pixels either by utilizing a hierarchical methodology or a granular perspective [7].

Milad Janalipour and Ali Mohammadzadeh et al. proposed a strategy for building harm identification in the metropolitan regions after the quake utilizing pre-occasion vector guide and post-occasion skillet honed high goal pictures. The area of the study taken was Bam located in south-western Iran. Once the images are obtained the pixel-based classification takes place followed by segmentation and labelling of various segments. The pre-event images were taken from Quick bird. Accuracy achieved was 76.36%. The authors recommend that high resolution images must be used for pre-event image as well. The model that they have used requires training thus this approach is partially automated [8].

Qingming Zhan, Martien Molenaar, Yinghui Xiao et al. did research on identifying urban land use classification of high-resolution imagery. Hierarchical method is used which consists of four layers: (1) intermediate image objects created on hierarchical segmentation, (2) Pixels from bottom layer (3) Intermediate objects obtained from various land cover forms based on their spatial properties and (4) Land use classification. Use of NDVI (Normalized Difference Vegetation Index) is made to identify the type of greenery surrounding the urban area. High resolution IKONOS imagery is used for obtaining the data for classification. However, the classification is limited to big objects only [9].

Shunichi Koshimura, Shintaro Kayaba and Hideomi Gokon et al. The creators fostered a procedure of item based satellite picture investigation taking advantage of high-goal present wave satellite picture on find and guide wave sway. The strategy is applied to Quick Bird 4 band dish sharpened composite picture got in Banda Aceh, Indonesia, and the ground objects are described into six; vegetation, water, soil, building, road and debris, for arranging the impact of the 2004 Sumatra-Andaman quake deluge. Using image analysis and mapping techniques will help in identifying the areas that are exposed to the tsunami [10].

Tapas Ranjan Martha, Norman Kerle, Cees J. van Westen, Victor Jetten, and K. Vinod Kumar et at. Used segment optimizing technique to detect landslides. High resolution images were obtained from Resourcesat-I. Analysis of the classified clusters was done using k-means. The avalanches were portrayed utilizing Digital Elevation Model (DEM) and its boundaries, for example, slant, stream, course, ebb and flow and slope conceal were determined from the computerized information. Low transitional accuracy of the shallow rock slides is not yet achieved up to the desired level [11].

Dirk Tiede, Stefan Lang, Petra Füreder, Daniel Hölbling, Christian Hoffmann, and Peter Zeil et al. proposed an approach for computerized extraction of harm sign from extremely high spatial goal satellite symbolism is introduced for the Haitian towns of Carrefour and Léogâne following the January 2010 earthquake. Damaged buildings are identified by changes to their shadows between pre- and post-event data. The approach makes use of object-based image analysis concepts to extract relevant information on damage distribution. This technique is more advanced if the pre and post occasion pictures are taken from a similar point. The programmed approach isn't intended to remove the outright benefits of concerning harmed structures, nor can totally supplant manual translation. The genuine strength lies in the capacity to quickly separating the data and helping the translators to rapidly acquire the spatial appropriation of the harmed areas. The shadow detection is a major constraint in this case [12].

Wenjuan Yu, Weiqi Zhou, Yuguo Qian, Jingli Yan et al. proposed a new methods in in classification of land cover by using backdating with object based image analysis. The data used was obtained from Landsat TM from 2001 to 2009 of the Beijing cities. With using the backdating with object based classification the accuracy achieved was 84.33% as compared to that of using it with the pixel based approach was mere 69.33% [13].

Muhammad Al-Amin Hoque, Stuart Phinn, Chris Roelfsemaa and Iraphne Childs et al. have used the article based approach land cover types in pre and post twister Satellite Pour L'Observation de la Terre (SPOT) 5 picture data to perceive explicit changes in the land types. The larger part planned harm was found in vegetation, trimmed terrains, settlements, and framework. The last appraisal of the effect of the twister was done in three ways: (1) Spatial effect map, (2) Change recognition and (3) Form of changes. It was a test to recognize the attributes of the trash to foster the order rule set. Nonetheless, this challenge was limited by utilizing converse participation capacities to order completely required classes inside a similar grouping level and to lead further change [14].

Kavita V. Mitkari, Manoj K. Arora, and Reet K. Tiwari et al. removed the frosty lakes in the Gangotri locale. The information utilized was gotten from LISS-IV. The new record was created Normalized Difference Supra Glacial Lakes Index (NDSGLI). Shadows in the pictures can be misclassified whenever Normalized Difference Water Index (NDWI) is utilized for the extraction of the supra cold lakes. Notwithstanding, streamlining the planning by utilizing a quality DEM incline data [15].

III. DISCUSSION

The increasing spatial resolution of remote sensing (RS) devices has created a new need for applications that use this data. The requirement for more effective data extraction from high-resolution RS imagery and seamless integration of that data into Geographic Information System (GIS) datasets is pushing geo-information theory and technique into new terrain. Many more fine landscape characteristics may be easily differentiated, at least visually, when the dimension of the ground immediate visual field (GIFOV), or pixels (picture element) size, lowers. The task has been to develop tried-and-true man-machine approaches that externalize and increase human interpretation abilities. The use of picture segmentation algorithms and the creation of so-called object-based classification approaches have yielded some of the most promising achievements in this research area. We'll look at how segmentation and object-based techniques enhance on standard pixel-based image analysis/classification methodologies in this chapter.

Satellite frameworks give an abundance of data on the Earth's surface and its credits, as well as a wellspring of forward-thinking data on the current status of the surface. The information (item) we need to get from the satellite picture is a topical guide, most commonly an enormous region land cover/land-use map, albeit somewhat detected maps are additionally turning out to be more well-known. The effective cycles used to arrange satellite pictures are a significant part in the accuracy of satellite-information based topical data. Numerous previous studies and dedicated study have shown the critical necessity of such processes.

On high-resolution data, pixel-based analysis is more difficult. When used to high resolution data, this technique proved less successful and time consumingsince it was intended for medium goal pictures (10 to 100 m). The interest for further developed discoveries from investigations of changes in the Earth's surface ultimately prompted the requirement for an altogether new strategy. An enormous piece of the inefficacy of the pixel-based method was because of the way that the human mediator was answerable for a huge part of the change identification picture understanding, which shows that the time and content viewpoints ought not to be neglected. The difficulty, according to the author, is that analysis of the data focuses only on individual pixels rather than the spatial patterns generated by the pixels. Despite the fact that this remark was not new, it became clear that a growing number of research and applications began to focus on picture segmentation. In the 1980s and 1990s, satellite image segmentation was sometimes utilized in remote sensing applications.

Coming up next were the main thrusts behind the shift from pixel-based to protest based remote detecting information investigation: (1) the interest for upgraded interpretative upsides of remote detecting information in different applications (for the most part in time correlation review and indications of remote detecting information utilized uniquely for arranging); (2) giving a wide scope of high goal satellite data, on which one can notice surface items more meticulously (remembering the developing revenue for the utilization of remote detecting information for arranging); as well as (3) expanding the accessibility of high goal satellite information, on which one can see surface particles.

Object-based picture investigation become famous in the spaces of PC vision, biomedicine, and nervous system science when the new century rolled over. This was for the most part because of the improvement of more effective methodologies in the space of pixel power values. The utilization of these calculations to the area of remote detecting was first ineffective; the recently made approaches neglected to give valuable outcomes. This was because of three variables. In the first place, satellite photos frequently cover a far more extensive district than the photos for which PC vision calculations were made.

Second, things of primary interest seldom have a "typical" shape on satellite photos, and they almost always lack distinct and unambiguous boundaries. In terms of location, size, form, and spectral domain, a given item might have a range of presences. Therefore, the scope of possible articles is assorted and unmanageable. At last, satellite pictures frequently incorporate multispectral information, are gotten at different times (time-frames), and have changing goals, all of which sway the strategies and substance of handling the 'looked' things. While object-based investigation was notable in the fields of geographic data innovation and organization picture handling, it was just utilized in a couple of disengaged endeavors and trials in remote detecting from the 1970s to the 1990s. A couple of measurable not entirely settled for each section in these tests, most of which were associated with the ghastly properties of a solitary phantom band. Nonetheless, the radiometric highlights of satellite pictures (portion radiometric change) and the absence of programming support hampered the main endeavors. Be that as it may, during the 1990s, when mathematical, surface, theoretical, and different qualities could be allocated to each fragment (because of higher spatial goal and in this manner a bigger number of pixels inside a singular section), the most common way of changing over a satellite picture into a topical guide at last moved towards object-based examination.

A. Object-based image analysis

The pixel-based examination is difficult to perform on VHR. This is because of the explanation wherein when the goal increments simultaneously the quantity of pixels will likewise increment continuously. Classifying those individual pixels is very time-consuming process, because for performing classification one single pixel is taken at a time is match with the spectral signature. This process is repeated till the last pixel is spectrally classified. The way that a singular pixel didn't address a substance of topographical reality has been disregarded for a long while. This was primarily an aftereffect of the concentrated advancement of pixel-based calculations, yet in addition because of programming and equipment limits. Programming, for example, Quantum GIS, ArcGIS, Ecognition, ERDAS Imagine, and ENVI have make the ways for object-based picture examination as a sub-discipline of Geographic Information System (GIS). The main impetus of the progress from pixel based to protest based investigation were: (1) increased resolution of the satellite imagery, (2) rate of the interpretation of different remote sensing images and (3) high level of the technology developed in processing of satellite images.

B. OBIA and GEOBIA

a. OBIA

Pixels are at first arranged into objects utilizing ghastly closeness or an outside trademark like possession, soil, or land unit in object-based picture investigation (OBIA). Numerous attributes, for example, unearthly, shape, and neighborhood, might be recognized. The mean worth yet additionally standard deviation of a specific phantom band are instances of ghastly factors; size, border, and conservativeness are instances of shape factors; and neighborhood factors reflect, for instance, the mean fluctuation of a thing comparative with hazier items. Everything is likewise a part of a 'super-object,' which is made by combining various more modest things into a greater one, and each might be additionally parted into more modest items called 'sub-objects.'

By putting rules into OBIA, information about a region may be added. While a social affair of trees, grass, and water is situated in a thickly populated region, it is probably a city park. A cluster of trees encompassed by various others, then again, is probably important for a timberland as displayed in Figure 1. This distinction can be laid out utilizing OBIA, yet not with normal otherworldly picture investigation. OBIA conveys improved exactness along with detail for order purposes overall.

Throughout the course of recent years, object-based picture investigation (OBIA) has emerged because of joining geospatial standards with complex picture examination techniques. To better use imaging as well as other image-like continuous data, spatial qualities such as size and shape, neighborhood as well as context, scale and hierarchy are used. Parallel to this, advancements in sensing devices and novel processing techniques (e.g. grid computing) have aided OBIA's maturation, allowing it to become a well-established strategy for picture comprehension. For properly processing the complexity of contemporary highest resolution images, OBIA conceptually employs two connected methodological pillars. Firstly segmentation/regionalization for visual object delineation and scaled and hierarchical representations, secondly sophisticated classifiers that reflect the connection among spatial and spectral features through learning algorithms or explicit transferrable rule sets. The term image analysis (rather than image classification) is being used to emphasize that OBIA is a continuous as well as cyclic procedure.

b. River Analysis

OBIA may also provide trustworthy results in situations when standard image analysis fails completely, such as when spectral attributes are ambiguous. An examination of the Ganges-Brahmaputra Delta in Bangladesh as well as India epitomizes this point. Images instantly demonstrate how rivers flowing towards the sea shape the terrain. An organization of dynamic and fossil wanders has created over the course of time. A finely nitty gritty organization of deserted wanders water filled or sediment or covered with plants, however continuously keeping the unmistakable wandering structure, might be found in extra to the waterway channels. The (fossil) wanders' unearthly qualities don't join them, yet their structure demonstrates their personality. Figures 1–3 depict the Ganges-Brahmaputra complex pattern, as well as show where OBIA outperforms spectral image analysis.

c. Land Use

Land use categorization is another example of OBIA's inventive application. 'Land usage' refers to an area's purpose, while 'land cover' refers to its outward appearance. Since there is nobody to-one correspondence among land use land cover, a solitary land-use class might relate to various land-cover classes, as well as the other way around. The land-cover class 'Grass', for instance, may associate to land-use classes like horticultural, diversion, private, or transportation, though the land-use class 'Private' can contain land-cover classes like rooftop tiles, grass, and trees. The reflectance caught in a still up in the air via land cover, and regular phantom picture examination makes it hard to separate land-use data from photos. However, by first subdividing an image into ownership objects using OBIA, it is feasible to build sub-objects based on spectral similarities as well as representing tiny land-cover patches that collectively fill up the ownership parcel. Land-use categorization from photos is possible thanks to the analysis of spectral but also form features of sub-objects.

d. Stand Density

In circumstances when pictures and apps aren't designed to work together, OBIA brings up new possibilities. Consider picture based stand thickness gauge, a basic timberland stock metric that mirrors the quantity of trees each hectare. Conventional stand-thickness gauge calculations work at the stand level and rely upon tracking down individual trees by analyzing the image for nearby maxima: tree tops. Neighborhood maxima showing tree tops are then counted for each stand, creating a stand thickness gauge. Since each individual tree crowns must be recognized, such an approach poses high demands on spatial resolution. Small tree tops get obscured when picture spatial resolution degrades, resulting in an underestimating of stand density.

Figure 1: Shows the Object-Based Image Analysis (OBIA) segmentation process[16].

C. GEOBIA

Individual pixel categorization is used in low-resolution image processing methods. Individual pixels in low-resolution pictures may include one or more land cover types. In high-resolution photos, however, intra-class spectral fluctuation is large. As a consequence, pixel-based algorithms in high-resolution picture analysis are failing to give greater accuracy. The single land cover is addressed as an article in Geographic Information Science (GIScience), and extra examination is embraced utilizing objects rather than pixels. OBIA is "a sub-discipline of GIScience centered to partitioning remote detecting (RS) pictures into significant picture protests and examining their qualities on a spatial, unearthly, and transient scale". OBIA's primary objective is to give a way for evaluating high-spatial goal photography using ghastly, spatial, textural, and topological elements. Geographic information (GI) as well as remote sensing are both used in OBIA. Computer vision, material science, and biological imaging are just a few of the fields that use image analysis. The term 'GEographic Object-Based Image Analysis (GEOBIA)' was begat by the creator to depict picture examination did by remote detecting researchers, GIS experts, and ecological disciplines. Creators performed overviews that brought about the revelation of 145 friend checked on diary papers relevant to GEOBIA. Notwithstanding, a writing search directed by found more than 600 important diary distributions on similar subject, demonstrating that the quantity of articles had quadrupled in four years. This paper additionally does a fast writing search utilizing Google Scholar, Web of Knowledge, and Scopus (Elsevier) with the terms OBIA, GEOBIA, division, object-based, per-package, remote detecting, object-situated, and other spelling varieties.

IV. CONCLUSION

The interpretation power of the object based image classification and analysis is far better than that of pixel based analysis because it is capable of providing a closer look on the human understanding. It is well preferred by the GIS scientist due to its property of enticing various attributes such as spectral signature, texture, contextual information, shape, size and color. Moreover, the amount of time consumed while processing the VHR images is more in the traditional approach. Considering a group of pixels into a single segment is more efficient as compared to taking a single pixel each time and classifying it into a class. However, shadows pose a great hindrance in mapping the object situated at higher altitudes. Also, the segmentation is a crucial step in object based image classification, performing that correctly in the first go may lead to quicker and more accurate results. Human involvement at the interpretation procedure is invariantly mandatory in both the approaches. The following is the study's future scope: During the preceding few decades, the world has experienced incredible and rapid advancement in the domains of remotely sensed, geospatial data collection, and mapping. In terms of its usage and application in many industries, the technologies are gaining popularity.

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