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ARTIFICIAL INTELLIGENCE AS PLATFORM FOR OBSERVATION OF EARTH CHANGE DETECTION

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Abstract- An interest to the observation of the change detection in the field of remote sensing today takes a vital place in satellite data processing. It makes possible to use satellite image for application in land cover and land use analyze for detection of any acquired changes. There is one more advantage that the use of space technology advances in Earth observation makes possible to collect continuously information for the same location and area which is excellent source for tracking along line of the process. It opens opportunity to study dynamically changing of the features of the Earth surface. In this paper has been demonstrated variety of approaches to change detection (semantic segmentation and classification) to achieve expected better outcomes for further use in a post-processing which can be used in a large variety of applications. Remote sensing is a tool for Earth study with use of specially developed detectors or satellites which would be integrated into geographical information system (GIS) as excellent source reflecting nature of the surface of the Earth. The main purpose of satellite data classification is to consider for processing of the area selected for study. The fact is that in such approach of processing artificial intelligence plays an important role in processing of satellite data for land use/land cover (LULC). This paper is dedicated to the use of artificial intelligence for change detection taken place in the Earth surface. It has been undertaken to demonstrate capability of supervised and unsupervised methods in LULC classification being to achieve expected outcomes in accuracy of Earth change detection [1].

Keywords: Change Detection, Artificial Intelligence, Remote Sensing, Machine Learning.

1. INTRODUCTION

The Earth has a great economical resource. It is necessary to conduct permanent monitor to know what happiness with our home being to satisfy economic, political and social needs. It is very important to understand changes in the Earth for management of land resources and assessment technological potential when happens changes where state authorities would be able make decision for minimization of negative consequences.

In order to achieve appropriate results is important to develop the system of change detection meeting standards and requirements of the system [2]. The land use is important for formation of visible physical components. It makes possible to investigate features of landscape for understanding of scale, positionally area location and circumstances of investigated area, behavior and condition of selected area from ecosystem point of view [4]. An importance of classification of land is to use selected for investigation area where is needed to strong classification of features. No doubt that the price of land for house construction can be absolutely different from the price of land for agriculture purposes [5]. Based on use of remote sensing method and GIS application is possible to collect information related to the features of the Earth. It is highly important for assessment of risk in terms of the monitoring in land degradation [6, 7].

It can be collected for a large-scale geographical area data and define natural quality and physical objects of area. It opens possibility to conduct permanent analyze of surface of the Earth and objects, tracking theirs changes by time and integration data [8] based on remote sensing method for observation Land Use and Land Cover [9]. As accepted Artificial Intelligence (AI) is the active and strong technique for development of computers and calculation systems who can carry out tasks where human intelligent need in this area. In accordance with the innovation operation algorithms of the artificial intelligence takes an important role in LC/LU, where for classification of LC/LU can be divided into different classes. Organization of the strategy is considered to choose two categories. In the first choose is to considered traditional machine learning (complicated classification, unsupervised and semi-challenging classes), up to date machine learning and bases on the knowledge of complex classes [10]. The fact is that AI is the useful instrument, that makes possible most effectively operation of software with lower cost [11] and less time spend which can carry out IBM human function as:

- Reasoning
- Planning
- Communication
- Perception

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Quantum computers has a big potential for improvement of AI algorithms and machine learning. This technology is not currently out of reach of a big scale of use by users. It is pleased to note that Microsoft, Amazon and IBM open sources throughout the cloud models for quantum computing and simulations [12].

2. LAND OBSERVATION SATELLITES

Change observation of the Earth is the ground system of photography scanning which collects, stories, analyzing and reflecting Earth photography with help of remote detectors upon equal time period [13]. Earth change observation uses for Earth change detection on the Earth with time period as well as for monitoring and analyze changes in the nature and other environments with use of physical, calculation and biological systems of the Earth [7]. Land observation satellites are applying for Earth observation from the orbit and use for a variety of purposes, mapping, monitoring of environment, meteorology and others. They in general include remote detectors and wireless devices [8].

The use of satellite technology in developed countries has led to a new approach of applications as well as in land use/land cover and Earth change detection [14]. This a reason of enhancement of satellite technology applications in a variety areas of Earth study. It opens opportunity to use advances of satellite technology with approach complex solution of existing problems and discover valuable features of investigated subjects [15].

2.1. Classes of Eart Observation Satellites

Spatial resolution of satellites defines capacity of definition in the minimum size of objects or elements reflected in the satellite image. The high spatial resolution demonstrates small size of pixels providing a more details of features of the object or element. It has been shown types of satellites in Figures 1, 2 and 3 with a capacity of spatial resolutions [15].

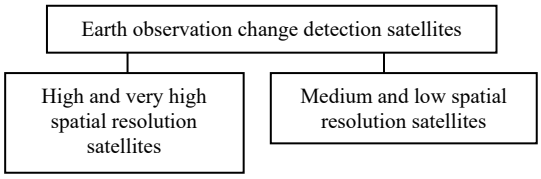

Figure 1. Earth observation satellites

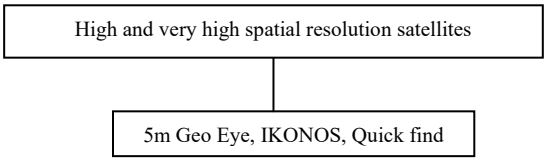

Figure 2. High and very high spatial resolution satellites

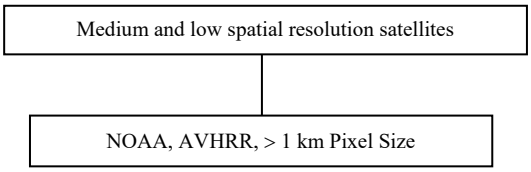

Figure 3. A medium and low-resolution satellites

2.2. Earth Observation Satellites (EOS)

There are principal differences between satellites of high and low spatial resolution. No doubt that high resolution of space image for instance 05-1.0 m/pxl has a good quality performance where easily can be fixed details of features of the objects on the Earth [16]. It makes possible to fix any insensitive segments of change detection. In this case the cost of satellite is enough high in case of medium and low spatial satellite images [17].

3. AI APPROACHES IN LCLU APPLICATION

For the time being is high demand to the mapping of LC/LU classification. It uses successfully of the method of remote sensing (RS) for satellite data processing. In order to achieve of the high quality of space information processing Machine Learning classification can take place significant role. In this case is very important to select good training samples and quality for processing being able to achieve expected classification of change detection features. It makes definitions to conduct thematic corrections, choose of classifiers and study of investigated areas. It opens good environment to get high accuracy results in data processing [23].

In the meantime, it can be used and integrated big amount of information with a Big Data with successful application up to date technology of identification as artificial intelligence (AI) and machine learning (ML) for LC/LU purposes [37].

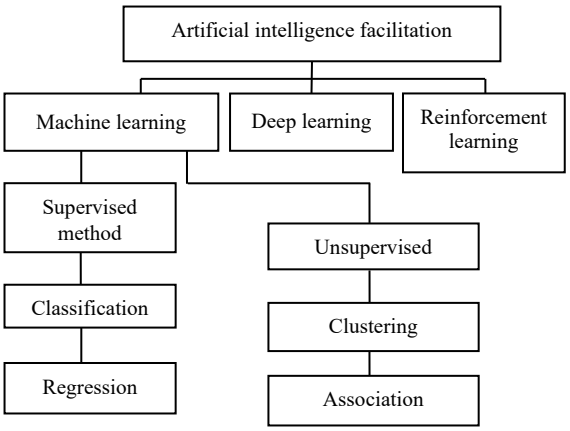

Figure 4. AI as a tool for LC/LU classification of change detection

3.1. ML Classification for LULC

Supervised classification approach based on the algorithms able to learn selected patterns. When we are saying ML is the techniques for collection of the flexible statistical prediction approach. It reflects presentation of each of parameter type with content of training data defining of supervised classification. The fact is that there are methods of use for processing is the random forest (RF) algorithm. It opens an opportunity to classify a big amount of information with high accuracy achievement. It mainly relates to learn the system development during the training process and selected trees anticipate the model of outputs. This approach creates an environment to minimize time processing thanks to effective selection of the samples considering for processing. It has described in [44] and demonstrated in Figure 5.

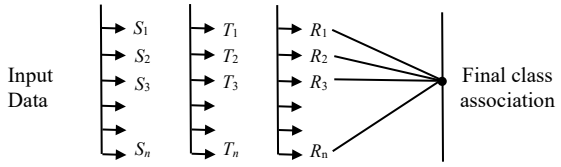

Figure 5. The structure of operation of Random Forest algorithm

An appropriate class categorized remote sensing classification is one of the popular used tools with high probability pixel [40]. It makes to achieve better outcomes comparative to other similarly approaches and methods. is used in distant detecting order applications [37].

3.2. Artificial Neural Networks

Artificial Neural Networks (ANN) is able to select some groups from different classes by means of identification of common characteristics of objects. A class known indicators is supporting to define whether the system correctly operating [37]. All layers like information, hidden and yield are developing strategy of the system [41]. This type of approach makes possible to minimize volume of input data where speed of processing can be increased and get the benefit of the time processing as well [42]. It can be objectively classified anomalies due to the similarity of geophysical parameters. In this case unsupervised classification of pixels with the similarity of spectral parameters of remote sensing data from satellite image [40].

3.3. Change Detection for LC/LU

There is no doubt that LC/LU development takes a vital place in land management of resources and assessment of needed technology application for land processing. It is obvious that decision makers can use successfully any change detection in LC/LU for better understanding change dynamic of ecological aspects and maintaining of long term of production effectiveness. From this point of view discussion of the identification of classification is the hard topic of LC/LU and demands strong and reliable method of LC/LU classification. Land cover is very important for formation of physically existing and visible surface land components [44]. The data of LC/LU is necessary for some of events on planning and administration as well as they are critical important components for demonstration and understanding of Earth the system as a whole [45].

It is important to point out that land cover and land use segments in all developments are taking vital place as assessment of natural and socio-economic component. An implementation land use and land cover segments are important in processing of deep data for variety of purposes carried out for the Earth's surface as well as application for human needs. It takes essential place for planet where it has overloaded condition need to undertake of land cover and land use for such directions such as agriculture, settlements, and industry. It is pleased to note that land cover and land use dataset presented in any form's maps or statistical data in the e-version creates excellent environment for land features like agriculture, forestry, economic production, settlements, and environmental/ecological studies for decision making with approach of management of pending processes [46]. The fact is that land use and land cover method open opportunity in assessment and evaluation existing problems taken within the scale of the regional socio-economic development of countries and management of natural resources, as Figure 6.

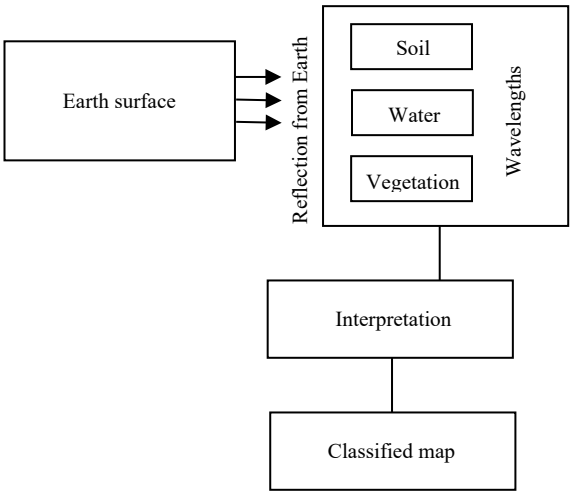

Figure 6. Land Use/Land Cover classification

4. THE STAGES OF DATA PROCESSING FOR CHANGE DETECTION

It has been demonstrated all the stages needed to be used for satellite data processing for detection of Earth observation changes. Figure 7 describes diagram of lines of follow up segments of satellite data processing.

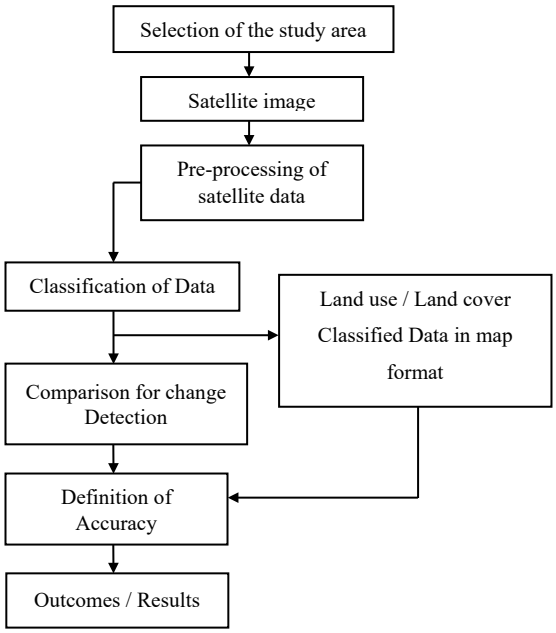

Figure 7. Methodology of satellite data processing

Application of LC/LU investigations can be used for sustainable development in the area of land cover change detection. In the meantime, it makes possible to define quantity and quality of water resources, land resources and management of costal line of the region.

The maps of LC/LU are plying important and key role in initiation of organization and monitoring for decision making stage. It is very important for appropriate decision making for the interest of the country and discovering change detection on the land cover and land use on the base of remote sensing. Classification information related to the change of the land is one of the important factors of land save and consideration of subjects' management and development [38]. The statistics of LC/LU is important for planning, business and regulation of the system. No doubt that information has a vital place for ecological safety issues and spatial location due to the spatial features. An organization of land use is necessary while it gives information which can be used for demonstration regulation of climate. For instance, models are managing of environmental changes and creating possibility to improve strategy [39].

The Land Use/Land Cover gives significant impact in development of the country regions. The land resources of the country take vital place in financing of national development program. An information related to the Land Cover/Land Use has a big value for decision making authorities who is responsible for land management. It makes possible to analyze of landscape models and features for understanding scale, coordinate system and circumstances as well as content and ecosystem. No doubt that classification of the land has a big value since depends of selected land for use can be reflected in different cost where high accuracy of demanding for land classification. For instance, the cost of land for building construction can be significantly different from the cost of land for agriculture purposes [40, 41]. It has a big importance and information for use of land.

4.1. Obstacles of AI Application in Land Cover/Land Use Classification

In spite of the significant progress achieved in the area of Land Cover/Land Use currently mapping of the land of land use is facing with a serious problem. The methods of artificial intelligence (AI) have a large-scale application and provides number of a new solutions in variety spheres of nature and challenges of the society. In the other hand the calls of the AI have a please in any selected areas. There are problems related to the methods of AI for implementation large scale mapping as well as challenges with control of land cover classification. Thanks to improvement of platform and sensor systems are in place a new problem such as big volume of data (satellite image resolution and multispectral characteristics) complicated structure of information (non-linear and overlapping distributions) and problems of the non-linear optimization (complicated high computation) [29].

A complication of data from different resources creates difficulties development of reliable and discriminative imagination from trained data with help of AI [30]. It can be undertaken as variety and valuable problem of data processing. A big trained sample are necessary for control of AI system, in general achieved on time-consumed data processing as human interpretation of remote sensing data and field observation. The fact is that there is a big problem in development reliable model approach with a small number of input data based on AI. In this case is necessary to develop a method for noncontrolled AI. There are number of models and structures of AI which are effective and accurate. For the time being researches are offering a new system of observation change detection on the base of AI. However, it is very complicated task for effective selection and provide correct for variety applications. In case of application is necessary consideration of AI reliability [31]. Some of researches are considering problems and offering viable solutions.

When we are using method of AI for observation of change detection is needed to undertake fac tors impaction on the usefulness of data preparations, model of training, features change detection and accuracy estimation. The main aim is to find more accurate AI structure for enhancement of accuracy of change detection [32]. It is necessary to point out that many of systems of change detection based on AI are providing structure model their trained parameters are not transparent which makes difficult to understand that how it works [33]. It is directed reliability of AI on development of methods enhancing accuracy and interpretation of the system of change detection observation. There is no doubt that in the end of implementation is necessary to develop the system of change detection observation which has to be resilient and interpretable [34].

5. CONCLUSIONS

The fact is that classifiers developing high accuracy Land Cover/Land Use maps have a big demand and it needs reliable information from satellite images achieved by remote sensing method even for big scaled and complicated data. Classifiers of the machine learning play a vital role in achievement of a good results classification. A some of aspects have an impact on accuracy of classified maps including size of trained selection, quality of trained selection, thematical correction, selection of classifier, scale of selected region etc. An understanding of those criteria will give an impact to achieve maximum accuracy of classification for identified needs. A problem with a big data occurs when classification task contains some of satellite images and functions are becoming intensive for calculation.

The main challenges related to the Land Cover/Land Use issues with use of remote sensing for providing accurate and timely geospatial information is correcting. The fact is that enhancement of cities for a long time were considered of power of regional economic force. In this case it was negative impacting on the ecosystem of environment including highways, quality of air, loss of agriculture areas, social aspects and cost of infrastructure. The program of natural resources management, planning and monitoring depends on accuracy of data related to the land cover in the region. A development of thematic maps on the base of classification with use of satellite information processing is the larger applied type of remote sensing with further use of up-to-date technology like artificial intelligence for change detection.

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