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Analysis of Land use and Land Cover Using Remote Sensing and Deep Learning

Sinchana H K, Shreya Kishore Pawar, Dhanyashree G N, Sushma K L

UG Student, Dept. of I.S., Malnad College of Engineering, Hassan, Karnataka, India

ABSTRACT: Identification and mapping of natural vegetation are major issues for biodiversity management and conservation. Remote sensing monitoring has two important sub fields viz, classification and change detection. Change detection from remotely sensed images is a process that utilizes the images acquired over the same geographical area at different times to identify the changes that may have occurred between the considered acquisition dates. Remotely sensed data with very high spatial resolution arecurrently used to study vegetation, but most satellitesensors are limited to four spectral bands, which is insufficient to identify some natural vegetationformations. To address this issue, this work intends to use multispectral and high spatial resolution data (Sentinel-2) to do the task of natural vegetation analysis using a popular CNN architecture. This proposed project concept is completely based on Deep Learning architecture using Remote Sensing technology for vegetation of lands in Hassan city of Karnataka India. The results are discussed within the scope of recent studies involving machine learning and Sentinel-2 data and key knowledge gaps identified. The changes of various vegetations are compared and their changes difference is displayed.

KEYWORDS: deep learning, Remote Sensing Technology, Land Cover and Land Use, DNN

I. INTRODUCTION

Remote sensing research focusing on image classification has long attracted the attention of the remote sensing community because classification results are the basis for many environmental and socioeconomic applications. Classification defines how much land area are occupied as agriculture land, forest area, water bodies, built areas, etc. Change detection can be defined as process of identifying of an objects or phenomenon at different times. Advanced classification approaches and techniques for improving classification accuracy. The global land cover is rapidly changing due to anthropogenic activities and natural processes. These changes impact human life, and hence effective monitoring mechanisms are needed for the sustainable management and utilization of natural resources. The development of satellite remote sensing technology has revolutionized the approaches in monitoring the natural and human resources on the Earth's surface, and this technology makes it possible to monitor large areas.

LCLU i.e., Land Cover and Land Use is basically fresh provocation under RS domain which leads in managing the use of earth land in systematic manner. Deep Learning methods are utilized for deep classification of lands. Decision making and planning are major advantages of these classification with the environment. Basically, the satellite data are used for these classification processes. Machine Learning (ML), Artificial Intelligence (AI) and Deep Learning (DL) are most used research areas for LCLU domains. These methods are of various kinds and has been utilized for more than a decade now, where they can be categorized as classical and recent and can be used in anyone of the ML techniques. Various techniques utilized in the modern technology are Supervised, Unsupervised and Reinforcement learning which used DL methods like CNNs which is a supervised classification approach and are basically used for image feature extraction. This work is completely based on deep learning approach and is a combination of science of modelling and analysis using various data and in future learns from these data of observations from environment which is fed into.

The proposed approach has two sub fields i.e., first the classification which defines the amount of agriculture land, forests area, water bodies etc., are available on the land area. Second Change detection that is knowing and gathering data about the land area at equal intervals of time which can be considered at different dates. These are usually observed at different time and date images acquired by satellites at same geographical area. This proposed project concept is completely based on Deep Learning architecture using Remote Sensing technology for vegetation of lands in Hassan Area. The results are discussed within the scope of recent studies involving machine learning and Sentinel-2 data and key knowledge gaps identified. The changes of various vegetations are compared and their changes difference is displayed and observed in percentage format.

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II. LITERATURE SURVEY

Early works as observed in land use and land cover uses multiple classification process. The techniques are unsupervised classification, Mahalanobis distance supervised classification, minimum distance supervised classification, maximum likelihood supervised classification, and normalized difference water index. It was concluded that maximum classification technique predicted an overall accuracy of 90%.

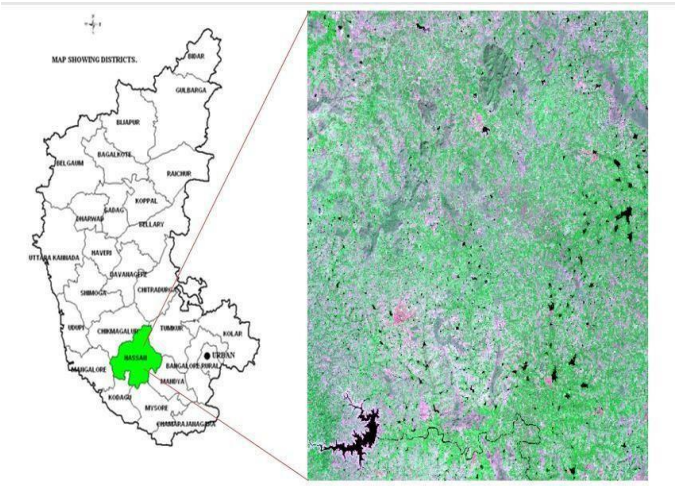

Figure 1: Study Area

III. DATASET

The MSI i.e., Sentinel-2 Multispectral Instrument consists two satellites which observes earth at 10m, 20m, and 60m spatial resolutions. The highest is the10m resolution and is more easily available satellite. They are powerful and unique that theywill be able to capture strong reflectance ofvegetation with infrared portion. One advantage of considering satellite image is that the data does not contain clouds or haze which may lead to discrepancy.

The images of satellite were downloaded from Kaggle website (https://www.kaggle.com/nilesh789/land-cover- classification-with-eurosat-dataset) which is an open source and contains number of data. It consists of 64x64 images taken from Sebtibel-2Asatellite and has 27000 images with 10 classes.Originally the data consists of hyperspectral imageswith 13 spectral bands but we will be working withonly RGB channels.

IV. IMPLEMENTATION

1. Pre-Processing & Feature Extraction

The images considered are RGB images which has different dimensions. The pre-processing part resizes the original images before sending them to DNN network. Later the resized image is converted to Grayscale image. The collected dataset is labelled and carefully segregated into folders. Presently the proposed techniques consist of 10 classes a number of images varies respectively. Here this step interpolates but does not compress much of data. OpenCV library is utilized in this step to transform the image.

2. Segmentation

Segmentation is the process the process of dividing an image into different regions based on the characteristics of pixels to identify objects or boundaries to simplify an image and more efficiently analyse it. When segmentation step is considered, the entire image is considered and involves few processes like detection and classification of objects present within the image. This process is worked at pixel level which helps to access the contours of objects within the image. When considering satellite images, there are various objects to be segmented; only focusing on our proposed objective. We are considering vegetation, land and water bodies for segmentation.

3. Training & Testing

The machine is directed and loaded to the path of dataset classes available and target are created. The Machine utilizes tensor flow an AI library which supports images and builds models for Machine to learn. The model accuracy and loss are initialized in graphical format. The Training of machine is completed using DNN architecture models. The

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model is stored in h5 format. While testing this model is called and input image is compared with the trained model and predicts required.

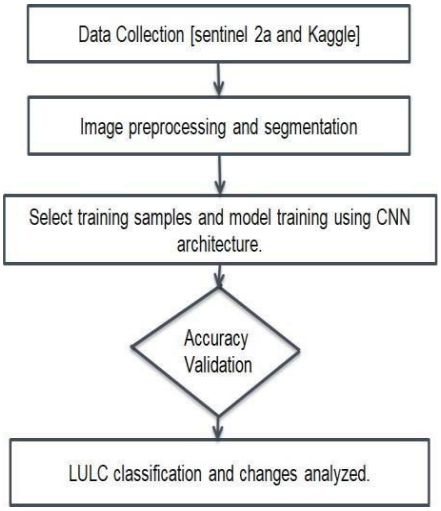

Figure 2. Proposed Block Diagram

V. EXPERIMENTAL RESULTS

The proposed methodology for Land use and Land cover are segmented for three main classes: Vegetation, Land and Water bodies using DNN. The accuracy obtained after traing is 95.6%. Hassan region satellite images of different years arecollected and their changes are observed in the percentage. The comparison is observed as discussed in Table 1.

No.	Year	Observed results		
		River Area	Vegetation Area	Others
1	2015	4.48%	57.08%	38.43%
2	2021	-1.96%	57.16%	40.87%
Observed after comparison		**-2.51% increase**	**+0.07% increased**	**+2.44% decreased**

VI. CONCLUSION AND FUTURE SCOPE

In this proposed paper, the current Deep learning method is utilized to study on LCLU. The technology Remote sensing is observed to be more accurate and efficient. Remote Sensing technology is the most recent method and research area for ML and AI. Though the images were satellite images, the proposed DNN method makes the model to learn quickly and segmented the images as required with respect to the classes. Imagery data collection and classifications are undergoing some challenges. These challenges can be resolved using more DL models which needs to be upgraded and applied on satellite data analysis. Deep learning approaches have provided major opportunities for analyzing Big data

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for remote sensing technology. More deep learning models which are researched have been preferred over many conventional machine learning methods.

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