

Review Paper of Land Use/Land Cover Changes Using Remote Sensing And GIS

Rohit Sharma¹, Pradipti chettri², Nikhil Sharma³, Grasey Gurung⁴, Zigdal Bhutia⁵

^{1, 2, 3, 4, 5} Dept of Computer Science and Technology

^{1, 2, 3, 4, 5} CCCT

Abstract- Remote Sensing and Geographical Information System (GIS) is very helpful for time-saving and also for the efficient land use mapping. Remote sensing helps to observe land without any physical contact with surface. The world has been facing problem from all the aspect due to the increase of population which is the main reason for the urban expansion increases in township. Infrastructure caused the use of forest land which leads to deforestation. Land use/Land cover map helps to map the total area covered and used, fights with environmental causes and also to manage the natural resource. Sometime, it's important for finding the change detection without doing a physical survey.

Keywords- Remote Sensing, GIS Approach, Change Detection, Land use Land cover

I. INTRODUCTION

The growth of a society depends on its social and economic development. This might be the specific reason why socio-economic surveys are applied. This type of survey includes each spatial and non-spatial dataset. Land Use/Land Cover maps play a big and prime role in designing, management and observation programmes at native, regional and national levels. This type of information, on one hand, provides the simplest way for better understanding of land utilization aspects and on the opposite hand, it plays a big role within the formation of policies and programmer needed for development designing. The terms land use and land cover are typically used interchangeably, however, every term has its distinctive meaning. Land cover refers to the surface cover on the underside like vegetation, urban infrastructure, water, blank soil etc. Identification of land cover establishes the baseline data for activities like thematic mapping and alter detection analysis. Land use refers to the aim the land serves once used alongside the phrase Land Use / Land cover (LULC) usually refers to the categorization or classification of human activities and natural components on the landscape at intervals a specific time frame. supported established scientific and math strategies of research of applicable source.

II. CLASSIFICATION METHOD

The Food and Agriculture Organization of the world could even be a specialized agency of the world organisation that leads international efforts to defeat hunger and improve nutrition and food security. That has also given some frameworks for Land Use/Land cover classification. Land Cover Meta Language could even be a general framework of rules supported mug and stratification of each phenomenon and abiotic parts which will be accustomed and specify any land cover feature everywhere in the planet, therefore creating accessible and a typical reference for land cover classification systems.

III. CLASSIFIER

Classifier are the building block for remote sensing that helps to identify the different object efficiently by using train and test data by providing the effective result. We also use machine learning like supervise, unsupervised and reinforcement learning algorithm for training and testing data.

I.K-Nearest Neighbours:

K-Nearest Neighbours could even be a supervised machine learning which assumes the similarity between the new block/data, also the available block and put the new block into the category which is as same as these categories. It stores all the available data and classifies a replacement information that supports the similarity and easily classified into a well suite category by using K- NN classification.

II. Maximum likelihood classification:

Maximum likelihood classification assumes that the statistics of every category for each band unit are commonly distributed and calculates the likelihood that a given panel belongs to a specific class. Unless we select a likelihood threshold, all pixels' unit will be classified so that every panel is appointed to the category that has absolutely the only likelihood (that is, the foremost likelihood). If absolutely the only likelihood is that that that that smaller than a threshold we specify, the panel remains unclassified.

III. Random Forest classification:

Random Forest classification is an ensemble learning technique which is build using multiple decision tree. The final word decision is made which are being supported the majority of the trees and is chosen by the random forest. A tree is utilized to work out an action. Each branch of the tree represents a possible decision or action Some advantage:

- Its add some extra accuracy to the classification
- It work well with large database and predict approximate missing data.

IV. THEMATIC MAPPER

The Thematic Mapper could even be a complicated, multispectral scanning, designed to understand the higher image resolution, slicker spectral separation, improved the geometric fidelity and bigger the radiometric accuracy and backbone than the MSS detector. TM data are detected in seven spectral bands at the identical time. Band 6 senses thermal (heat) infrared. Landsat will solely acquire night scenes in band 6. A TM scene includes a moment Field of View (IFOV) of 30m x 30m in bands 1-5 and 7 whereas band 6 has degree IFOV of 120m x 120m on the surface.

V. ISODATA

ISODATA unsupervised classification calculates the class which suggest that the equally distributed within the data space then iteratively clusters will be the remaining pixels victimization minimum distance techniques. Every iteration recalculates and suggest that the reclassifies pixels with relevancy that suggests that new reiterative category cacophonous, merging, and deleting is finished supported input threshold parameters. All pixels are categoryified to the closest class unless a daily deviation or distance threshold is such, during which case some pixels could even be unclassified if they're doing not to meet the chosen criteria. This method continues till the number of pixels in every category amendment by the chosen pixel change threshold or the utmost number of iterations is reached.

VI. OBJECT ORIENTED CLASSIFICATION

Object-oriented classification involves the identification of image objects, or segments, that are spatially contiguous pixels of comparable texture, colour, and tone. This approach permits for thought of form, size, and context furthermore as spectral content. Relationships between objects will play a big role in their identification and classification. Object-oriented strategies are usually more practical than pixel-based methods once classifying high-resolution basic

noises as a results of as, spatial resolution increases, the additional variability there's also within the spectral content of individual pixels all belonging to identical category.

VII. COHEN'S KAPPA COEFFICIENT

Cohen's kappa coefficient (κ) could even be a statistic that's accustomed measure inter-rater dependability and conjointly Intra-rater reliability for qualitative things. It is usually thought to be additional measure than easy percent agreement calculation, as κ takes into consideration the likelihood of the agreement occurring accidentally. There's disceptation encompassing Cohen's kappa due to the issues in interpreting indices of agreement. Some researchers have suggested that it is conceptually simpler to evaluate disagreement between things.

VIII. CA MARKOV

The Markov chain and Cellular Automata (CA-Markov) model, one of a mixed model is that the hybrid of the Cellular Automata and Markov models. This model effectively combines the benefits of the long-run predictions of the Markov model and the ability of the Cellular Automata model to simulate the spatial variation in an exceedingly complicated system, and this mixed model will effectively simulate zaland cover modification. A model is outlined in a group of random variables $X = \{X_t: t \in T\}$ defined on a typical changed area, taking values in an exceeding common set S (the state space), and indexed by a collection of T , usually either N or $[0, \infty)$ and thought of as time (discrete or continuous respectively).

IX. TERRSET

TerrSet is an integrated geographic information system (GIS) and remote sensing software. It used for analysing and displaying the geospatial information. It is known for advancements in areas such as decision support, uncertainty management, classifier development, change and time series analysis, and dynamic modelling.

X. LITERATURE REVIEW

In [1] author has talked about the what is Land Use/ Land Cover according to them land cover are refers to the earth cover of ground it can be vegetation, urban area, water shade, desert. Identification of those land cover helps us to create thematic maps of the area to find the changes occurred in that area. They have discussed how LULC help us in resource planning, monitoring change detection. They have shown how we can classify the land cover using supervise and

unsupervised learning. They have talked about the Normalized Difference Vegetation Index (NDVI). And how its help used to detect vegetation using the index.

In [2] author has talked about the how land use/land cover helps us to solve so many problems related to the environment and urbanization author said that the how it helps policies makers to make and implement policies. Author also discussed about the growing importance of the land use/land cover, author has also shown who all uses the it. Author have told about the how land use/land cover is practiced on a piece of land, how it helps to find the change detection.

In [3] author has defined land as “A delineable area of the earth’s terrestrial surface, embracing all the attributes of biosphere” [3] the author here wants to say that the land is a depict area of earth surface which has ever possible aspect for life to survive. The author has also give a brief of all possible land classification. They are “Artificial surface, Agricultural areas, Forests, Semi-natural areas, Wetlands and Water bodies” also talked about the need of land use/ land cover data. Also talked about the different classification algorithm that can be used for classification.

In[4] author has talked about how LULC of AL Ain help them to found the urban expansion. They have used MSS (Multispectral Scanner), Thematic Mapper (TM) and Enhance Thematic Mapper Plus. They used three different Landsat of three different years. They used hybrid classification schema using ISODATA algorithm & The Maximum Likelihood algorithm and their result were more interesting they found that LCR witnessed an increase to 0.080 as the growth in urban areas was greater than population growth.

In [5] author has shown how they made a land use/land cover of Tongren Region using Satellite imaginary of SPOT 5 they have used eCognition object-oriented classification method they have to use FAO (2001)for classification. In this research, the object-oriented LULC classification method is used. Their result was more precise but there is some certain error in object-oriented geo-object classification method. Accuracy level can be increased by using the nearest neighbour method. The total accuracies of the classification of their research are to obtain 93.97% and 95.39% respectively.

In [6] author has talked about the how LULC play a major role in the study of global changes like deforestation, biodiversity loss, global warming and so on. They created an elevation model with the pixel dimension of 50 x 50m they have also used Maximum Likelihood algorithm for the accuracy assessment they use Kappa statistics for deriving the

error matrices. Their results showed that there is an increase in the cultivation area and a decrease in the forest area. The results indicate that severe land cover changes have occurred in agricultural (36.2%) (especially in tea gardens), urban (117%), pasture (-72.8%) and forestry (-12.8%) areas have been experienced in the region between 1976 and 2000. It was seen that the LULC changes mostly occurred in coastal areas and areas having low slope values.

In [7] author has talked about how they made Land use/ Land cover of Gangtok using IRS 1D LISS-3 using bands 2, 3 and 4, Land use analysis was performed using topographic maps and satellite images year 2000 they have used supervised classification method. As their classification model. Results of the study exposed the existence of urbanization that especially the forestlands in and around Gangtok, bounded in Rani Khola and Rora Chu.

In [8] author discussed about how land use/ land cover is done using K- Nearest Neighbour. It is a common classification method that is used in data mining. K-NN is not so popular and not that accurate and has many errors when training data but it is good if we use it with object- oriented classification of high resolution remote sensing image.

In [9] author has discussed about how the we can use CA Markov model to predict the land use land cover changes the author took the data of 1992, 2003 and 2014 and used maximum likelihood classification for the classification and used kappa coefficient for the accuracy testing and got a kappa index of 0.82128. They used CA- Markov analysis for predicting the changes. There Overall classification accuracy in 1992, 2003 and 2014 are 94.94%, 92.12% and 92.33%, respectively, with Kappa indexes of 0.9254, 0.8964 and 0.8746, respectively. They showed that in span of 10 years more than 30% of waterbodies and farmland has changed and over the span of 20 years 45.34% of changes has been followed up. These result are obtained using CA Markov model in IDRISI Software based on the suitability atlas has already been created.

In [10] author in this paper is trying to find the urban expansion using the data of 1998to 2016 they have used Support Vector Machine is used for classification and they have used for the hybrid simulation of CA Markov model for the they compared the of 1998 to 2016 the average annual growth was 9.15% with any overall growth of 346.85% overall accuracy was observed based on the field reference data topographical maps published by Survey Department and high spatial resolution images of Google Earth.

REFERENCES

- [1] Yashwant Singh. “Significance of Land Use / Land Cover (LULC) Maps” Available at: <https://www.satpalda.com/blogs/significance-of-land-use-land-cover-lulc-maps/> [Accessed 14/Feb/2020]
- [2] Saurab Babu. “The growing importance of Land Use, Land Cover (LULC) studies in environmental planning and policy” Available at: <https://eco-intelligent.com/2018/04/24/lulc-land-use-land-cover-studies-and-its-growing-importance/> [Accessed 14/Feb/2020]
- [3] EESA NOVA, Mario Caetano, D3L1 LULC applications, “Advance training course on Land Remote sensing” [Published on Sep. 5, 2007]
- [4] S. M. ISSA and A. AL SHUWAIHI. “Analysis of LULC changes and urban expansion of the resort city of al ain using Remote sensing and GIS” [Publicised on 2011]
- [5] Yikuan Zhang, Ke Lu, Ning He and Peng Zhang “Research on Land Use/Cover Classification Based on RS and GIS” [Publicised on 2007]
- [6] Aksara University, Faculty of Engineering, Department of Geodesy and Photogrammetry, Selçuk Reis “Analysing Land Use/Land Cover Changes Using Remote Sensing and GIS in Rize, North-East Turkey” [Published on 19 August 2008]
- [7] Ashok Kumar Sharma & Varun Joshi. “Land Use Pattern mapping using Remote Sensing and GIS in Gangtok area, Sikkim Himalaya, India” Available at: <https://www.geospatialworld.net/article/land-use-pattern-mapping-using-remote-sensing-and-gis-in-gangtok-area-sikkim-himalaya-india/> [Accessed at 12 Feb 2020]
- [8] MAYANKA B. KHUMAN “Classification of Remote Sensing data using K-NN Method” Available at: <https://www.semanticscholar.org/paper/CLASSIFICATION-OF-REMOTE-SENSING-DATA-USING-K-NNKHUMAN/4a30934c3bdf595ddfed32271dbba070f73571b1> [Published on 2013]
- [9] CHEN LIPING, SUN YUJUN*, SAJJAD SAEED “Monitoring and predicting land use and land cover changes using remote sensing and GIS techniques A case study of a hilly area, Jiangle, China” [Published on July 13, 2018]
- [10] Bhagawat Rimal, Lifu Zhang, Hamidreza Keshtkar, Barry N. Haack, Sushila Rijal and Peng Zhang “Land Use/Land Cover Dynamics and Modeling of Urban Land Expansion by the Integration of Cellular Automata and Markov Chain” [Published at 19 April 2018]