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Satellite Image Classification for Detecting Unused Landscape using CNN

Akshay S
Department of Computer Science
Amrita School of Arts & Sciences
Mysore, *Amrita Vishwa Vidyapeetham*
India
s_akshay@asas.mysore.amrita.edu

Manohar N
Department of Computer Science
Amrita School of Arts & Sciences
Mysore, *Amrita Vishwa Vidyapeetham*
India
n_manohar@asas.mysore.amrita.edu

Mytravarun T K
Department of Computer Science
Amrita School of Arts & Sciences
Mysore, *Amrita Vishwa Vidyapeetham*
India
t.kmytravarun@yahoo.com

Pranav M A
Department of Computer Science
Amrita School of Arts & Sciences
Mysore, *Amrita Vishwa Vidyapeetham*
India
pranavma2@gmail.com

***Abstract*— As the landscapes changes day by day it leads to the increasing use of unused lands, by which unused lands can be used for various purposes like agriculture, developing city infrastructure and many more. This paper helps in automating the process of detecting the unused land space. In this work, a system for satellite image processing that detects unused land is proposed. Here remote sensing earth images are taken as the dataset where the pre-processing step includes converting image into greyscale image, compression and noise removal. Segmentation is done to partition the region of used and unused lands. Feature extraction is done here using local binary feature extraction in-order to identify edge, flat and corner surfaces. As the mentioned various algorithm is used in classification and labeling of remote sensing earth images. CNN algorithm is also used for classification and labeling of classification is done automatically by the use of CNN algorithm. Random forest is used to segregate two landscapes as used and unused land which gives accuracy better than the existing systems.**

Keywords— Satellite image, Compression, LBP, Region Based Segmentation, CNN, CBIR

I. INTRODUCTION

Satellite images are snapshots of Earth or other planets obtained by imagery satellites run by global business and government officials. Satellite imagery companies market the images by granting government and company licenses such as Google and Apple Maps. Satellite images have numerous uses in oceanography, fisheries, forestry, forests, deserts, meteorology, geophysics, and cartology, support centers for regional satellite communication, surveillance, education, and warfare. Sometimes the pictures are in visible colors and other spectrums. And maps of elevation, typically created from radar photos, exist. Satellite image processing and interpretation is performed using advanced remote sensing technologies. Satellite Image Processing is field where lot of research and development projects is being done. The snapshots of earth and satellites are taken by artificial satellites.

The snapshots are taken in a digital form and these are processed by computer to extract the useful information. The satellite images are utilized to monitor the environment or surrounding condition or to notify of any disasters which can happen in future. Satellite Image Processing is the remote sensing where it works on pixel resolutions which collect the knowledge about earth region. The various types of resolutions of satellite imagery are as follows.

- **Spatial resolution**: It is defined as total pixels used in building of digital image. Digital images which have high spatial resolution are collected with more number of pixels than the low spatial resolution.
- **Spectral resolution**: Here the power of a sensor is to define wavelength intervals. Finer the spatial resolution closer the wavelength ranges for a specific band.
- **Temporal resolution**: The taken time to review and occupy the data for the same field to be collected. The amount of time depends on the orbital characteristics of the sensor platform and the characteristics of the sensor in remote sensing.
- **Radiometric resolution**: It is described as how much information is inside the pixel and how is it expressed in units of bits. It is represented with binary decision of yes or no, or even with a binary value 1 or 0. There are many unused land in the environment which can be used efficiently. Due to unused lands it is resulting in dumping of wastes, increase in number of crimes, and no proper shelter for poor people. These problems can be overcome by improving city infrastructure which helps for the society. One official person has to be present physically to examine the unused land whether it can be used or not and after that has to measure the area of the land which is time consuming and complicated procedure. Through this this proposed system i.e. Satellite Image Processing for Detecting Unused Land Using Machine Learning will help to detect the unused land through the input of Satellite Image

which detects and classifies as used and unused land. For classifying it includes machine learning algorithms to classify it as used and unused. Used land includes buildings, rivers, forest, roads. For unused land, it includes agricultural land, vacant sites and grounds. For these results, it includes the various steps to be performed satellite image is taken as the input pre-processing steps to be followed. Input image is converted into grayscale as the image must be in 2-dimensional array. Noise removal is done using Gaussian Filter; it is used to remove any noisy particles in the image that may vary in the result. Segmentation is done using Region-Based Segmentation, which is used to divide into 2 regions i.e. Used and Unused area in segmentation White surface implies it is unused area and Black surface it is used area. The edge detection technique is used to extract the clear and sharp edges of objects from the input image, here 3 Edge detection techniques were used Robert edge detection, Sobel edge detection, and Canny edge detection. When compared to other 2 edge detection techniques Canny edge detection gave more accurate result compared to them. Feature extraction is done using Local Binary Pattern Feature extraction to extract the features of corner, flat and edge surface region of the input image. Convolutional Neural Network is used to classify the land into used and unused land. The confusion matrix is been built automatically and 3 accuracies has been calculated and getting 89% accuracy of overall confusion matrix table.

II. LITERATURE SURVEY

[1] The paper explains about the classification of the satellite images accurately using labeling of images like buildings, schools and factory. Here in this paper, the dataset they considered is an aerial view of satellite image where they need to sharpen the object so as the classification of maps be accurate as different buildings have different dimensions so in-order to make it accurate sharpening of objects technique is used. Here they have used RNN algorithm over CNN algorithm because in CNN algorithm is not suitable for the datasets they have considered, as it seems unfeasible for large scale satellite images. The labeling images are done automatically by CNN algorithm. Here the purpose of using RNN algorithm is used as labeling of images is done manually and they are trained to improve the classification of images.

[2] The paper discusses more about measures taken in image processing. The algorithms used to process multi-spectral imagery of the satellites. The image filter algorithms used for object detection and boundary delineation are shown here. The use of DSM in filtering algorithm is based on ARMR, which allows all filtering input images to form an effective algorithm. Here the three research multispectral images are collected from the Landsat 8 spacecraft to display pieces of every single frame. Eight spectral ranges are used at each processing stage of the multi-spectral imagery. The inter-frame correlation rates are from 0.61 to 0.99. They concluded that the procedures and sequences implemented new image filter. The aim of this step is to provide the chance of a coincidental estimate of brightness and the image's co-relationship properties. This helps in processing the spatial non-uniform image without conducting the labor-intensive initial segmentation. Here, as a result, it was found that the gain is up to 40% on an average distribution of predicted error. Which here helps for the initial process of satellite material for resolving the problems of image reconstruction and detecting anomalies.

[3] This paper tells about the PSO (Particle swarm optimization) and Random Forest classification they have considered Google earth imagery and multi-temporal imagery of Canadian prairies. Random Forest algorithm is used to segregate two landscapes with 90% and 100% accuracy. PSO algorithm is used for randomly selected particles that is moving in seeking the space with a speed where it is tuned with respect to its particles and behavioral in population. Based on the variety of dataset used the result depicts clearly that these techniques are better techniques to classify images based on example dataset i.e., training dataset. The comparison of results with the results of other algorithms shows that these techniques are better.

[4] In this paper details about the cross sharpening of multi temporal data. The data sets they have considered is satellite images and multi temporal data for resolution satellite imagery clear the supervisory changed detection is based on the perspective where the supervised method measures the ground cover transitions and also unsupervised methods are shown in the form of binary maps including the changes in the area if there are any here they have also used MSRG algorithm which is used for attempting the aggregate of unlabeled pixel to one of the seed region and it is automatic co registration. Generation of cross sharpened images the data sets their considered are Pan sharpened image, multi-temporal image and multispectral image. The advantages of these are it helps in image segmentation to detect the objects in the taken input of the satellite images.

[5] In this paper details about quantifying offline transformation with the use of multi-temporal satellite data and GIS technique are given. The dataset they have considered are IKNOS satellite in GST latitude and longitude of the city and it is temporal map of land use or land cover map. IKONOS satellite provides panchromatic natural color infrared and stereo images in particular this is useful for current or graphic and photogrammetric and various remote sensing applications. Here IKONOS can provide the coverage of whole globe since it offers both nadir and off-nadir modes. With the help of GIS here they have prepared the road network map which helps in labeling the data.

[6] In the paper details aerial and satellite imagery. Datasets and algorithms which they considered are ISPRS 2D semantic labeling color infrared images RGB satellite imagery multimedia images convolutional neural network CRF post processing step DB and feature for scene classification and special pooling layer. With the help of CNN algorithm it helps to classify the data set without class label as it is done automatically by algorithm. DBN feature is used in order to classify the scene of the satellite imagery which are identified as mountains or hills stations or any other nature places. Random sample consensus algorithm is used to estimate the homograph between the Google images and ISPRS data. You

are the temporal changes are marked in red color that changes time to time according to the various datasets.

[7] In this paper details about the detection by classification of buildings of multispectral satellite imagery. The data sets and algorithm considered are RGB images, satellite images, multispectral images, Landsat 8 satellite semantic segmentation and CNN approach. Convolutional neural network is used for detection of objects in satellite imagery and the resulting network is used to identify the buildings in satellite images in real time scenario. Here are some of samples are shown for the result of the proposed method here they have shown the classification the detected solar power plants which helps us to estimate the energy production are also to assist the landscape planning you are the classifying network has been adopted to conduct this cement segmentation with conversion of the fully connected layer to conventional their convolutional neural network is used for road detection in this project here they train the conversion using neural network from beginning of classification which permits the model for processing of multispectral input image where can then detect by converting the fully connected layer into convolution and there which allows real time processing of higher resolution of satellite imagery. In this paper they have also shown taking the others ohm's the example and show how to classify and also detect the objects.

[8] In this paper details about taking satellite imagery as the input and extracting the features as image similarity estimation. The data sets and algorithms considered are satellite images OASIS algorithm, content based image retrieval systems, Meta heuristic algorithm, Worldview 2 and Worldview 3 satellites image segmentation mean shift clustering histogram distance computation. CBIR systems are worth by Rita in the images where input message is related from which database is where it was proposed in the difference between the features of input image and feature database image is calculated using a meta heuristic algorithm image distance is used for measuring the comparison of two images hear more important Li color is used as the only feature which can predict the distance between the image. Here the use of satellite image resolution in Huntsman technology is based on HSV hits CD conversion and wavelet transformation, allowing the spatial resolution of primary digital images to be enhanced and spectral dissertation in local areas to be avoided. The purpose of use of this algorithm is that it relates the unsupervised clustering here the main purpose of this algorithm is used to predict the kernel density of pixel distribution in RGBXY feature space, after the use of this algorithm in the satellite imagery it shows what all the object classified in satellite image are. Here the distribution of each class histogram for each images are tested in the data set which was buried, histogram represents the contextual description of images.

Through this literature survey it is evident there has been lot of work done on classification of satellite images. Most of the existing systems used Machine learning techniques such as Random Forest, RNN and CNN for the purpose of classification. Most of the existing system tried to classify images based on features into different classes as per the label in the dataset. This motivated us to use LBP, Feature Extraction Method and CNN for classification as they prove to be more efficient than other algorithms. The Literature survey also helped us to learn that there is enough scope for a system that classifies the used and unused landscape in satellite images.

III. PROPOSED SYSTEM

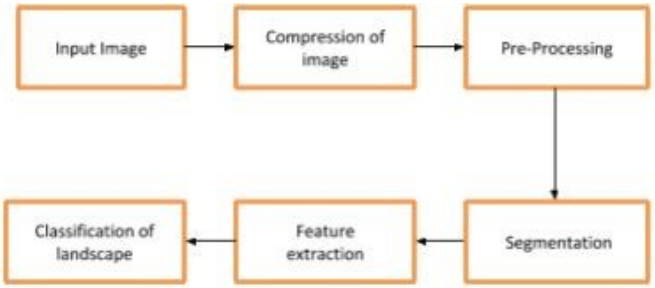


Fig 1: Proposed system

As depicted in Figure 1 the proposed system consists of the following steps:

A. Input images

The image data collection contains 2 datasets.

For Dataset-1 the satellite images are taken from Landsat and Eurosat. Now about 1000 satellite images are used that have sub-classes like forest, desert, beach, highway, land, river and agriculture. Each image is resized to 64x64 bits which help to execute quickly.

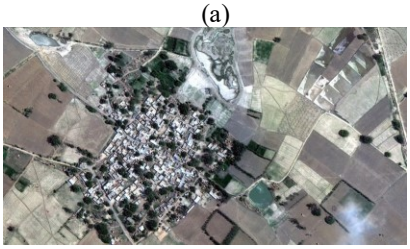
For Dataset-2 the dataset is collected through www.satimagingcorp.com . It is a website where it allows downloading satellite imaging; it is archived as QuickBird Satellite Images. Using a state of the art BGIS 2000 sensor, QuickBird satellite collected the image data of 0.65m pixel resolution degree of detail. This satellite was the excellent source for environmental data which is useful for analyzing the changes in land usage, agricultural usage and forest climates. QuickBird imaging has the capability that when applied to a host of industries including oil and gas exploration and production, construction and engineering and environmental studies. Now 27 satellite images are used which has 6 main category and 10 sub-category. Each image needs to be compressed to execute quickly.

B. Image Compression

The satellite images are generally big and this increases the amount of time taken by the system for processing of the image. It also affects the memory. Even though having today the best of the computing power and cheap memory it is wise to compress the image in order to reduce the computational time and memory complexity. There are lots of image compression techniques. Some of the compression techniques are by nature lossless and a majority of them are lossy compression techniques. In this FMM compression technique have been used to compress the images [9]. Each picture compression has the most critical aspects to reduce duplication in the picture and remove irrelevant neighborhood. FMM is

one approach where images are compact by splitting the image into8-by-8 sections. This then transforms every pixel to a divisible amount by 5. Now you can recreate the entire image with values which are divisible by 5. The pixels are splitted up into 5 instead. Where got a new pixel value, which is even smaller than the previous value. So, from each line is subtracted the digit with the minimum value. Ultimately, got a new matrix that defines the image with a larger pixel value of 8 that is declared with just four bits

(a)

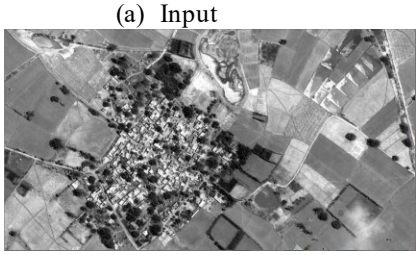


(b)

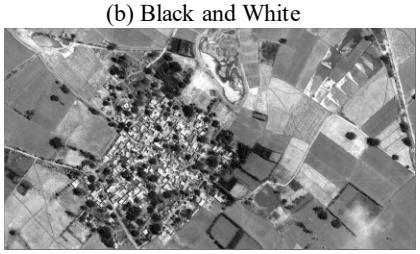
Fig.2. (a) Input image
(b) FMM compressed image

C. *Image Processing*

(a) Input



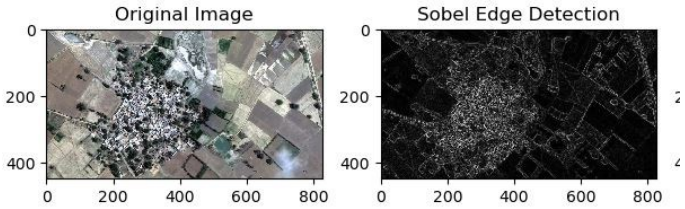
(b) Black and White



(c) Noise Filtered Image

Fig.3. Noise Filtered Image

The compressed images from the previous step are fed as input to the preprocessing module. The given images are preprocessed for better results. The preprocessing step includes converting the image into RGB and gray scale image.it also includes noise removal process in which the surrounding noise is removed. The edge in the images is detected using edge detection techniques. Almost the shape information of an image is present within the edges. At the initial step detected the edges in the image using different filtering algorithms and improvising the areas of image which contain edges and sharpness of image which can increase image quality and become clearer. Roberts Edge Detection is used to detect the edges of given input image based on applying both horizontal and vertical filtering's in sequence. The image is distributed both horizontally and vertically, and combined to form the final result. Here in the above output it shoes the edge detection of used and unused land. Black surface indicates a used area and White surface as unused area but compared to canny edge detector and Sobel Edge Detector it's not more accurate. Here in the above output it shoes the edge detection of used and unused land. Black surface indicates a used area and White surface as unused area but compared to canny edge detector and Sobel Edge Detector it's not more accurate. Sobel Edge Detection performs 2-D geospatial gradient analysis on input image and highlights higher spatial frequency regions that are close to edges. It is most widely used to find the estimated gradient magnitude at each point of a grayscale image input. Here in the above output, it shows the edge detection of used and unused land. Black surface indicates a used area and White surface as unused area but compared to canny edge detector it's not more accurate. But it's more accurate than Roberts Edge Detection. Canny Edge Detection is a multi-algorithm technique used to detect a wide variety of edges in an input gray image. It is used to extract the desired structural information from an image. Here the above output shows the edge detection of used and unused area. Black surface indicates the used area and White surface indicates the unused area when compared with the above 2 edge detection technique i.e. Roberts Edge Detector and Sobel Edge Detector, Canny Edge Detector results are more accurate. Also, Canny Edge Detection is named as best Edge Detection technique compared to other technique as it produces a more accurate output result.



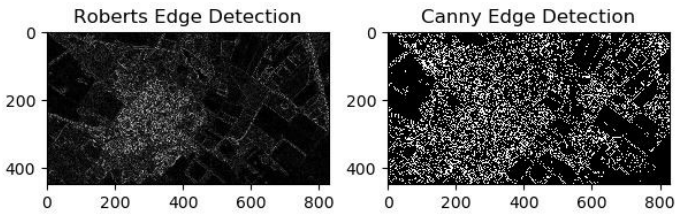


Fig.4. Edge Detection Results

D. Image Segmentation

It's the method of breaking the digital image into separate parts. The role of segmentation here is to of the representation and turn it into more relevant and easier to analyze. For an input image, the technique of segmentation is essentially used to define objects and borders. The methodology used here for segmentation is Region Based Segmentation. The aim of this segmentation is to partition the image into various regions. Segmentation methods such as Thresholding segmentation achieve the aim based on the discontinuities of grayscale or color properties by the boundaries of the regions. Regional segmentation is a method where the regions are specifically assessed The basic mathematical formulation for Region-Based Segmentation is

$$(a)\ \bigcup_{i=1}^{n} R_i = R.$$

$$(b)\ R_i \text{ is a connected region, } i = 1,\ 2,\ \ldots, n$$

$$(c)\ R_i \bigcap R_j = \varnothing, i \neq j$$

$$(d)\ P(R_i) = \text{TRUE for } i = 1, 2, \ldots, n.$$

$$(e)\ P(R_i \bigcup R_j) = \text{FALSE for any adjacent region } R_i \text{ and } R_j.$$

P(Ri) is a logical predicate that is specified above the points in the Ri set and omitted. This implies segmentation should be complete i.e. every pixel in the area should be present. It means that it requires that certain points must be connected to any of the predefined meaning in a given field. It means division of the regions. It checks the characteristics which the area segments should be consistent with. It means the Ri and Rj area are separate from P predicate. Regional segmentation is important because it clearly distinguishes the regions that have common properties defined by us. It produces precise results that have consistent edges and reliable segmentation performance. To epitomize the property it takes only a small number of seed points. At the same time it can select several parameters.

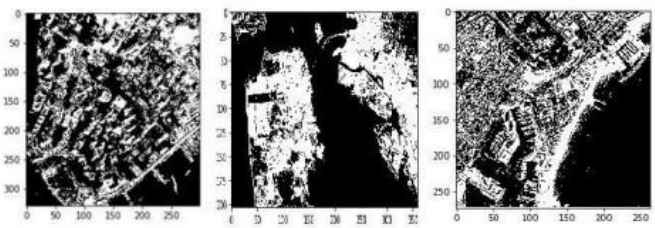


Fig.5. Region Based Segmentation results on few images

The above result has been classified into 2 regions i.e. Used and Unused regions. Black region signifies it as a used area and White region signifies as unused area. Here it is providing clear edges with good segmentation result.

E. Feature Extraction

It is important for the reduction of dimensionality. When data is inserted into an algorithm, it is too big to be processed and further complexity would result in it being divided into functions. The selected features (of divided set of features) will be containing set of relevant information from input data so that desired task can be performed. The feature extraction technique used here is Local Binary Pattern Feature Extraction. Local Binary Pattern Feature Extraction- It is a technique used to classify the texture based on LBP (Local Binary Pattern). LBP checks the dotted elements of a central point and tests if the surrounding elements are larger or smaller than the central point which is a binary outcome.

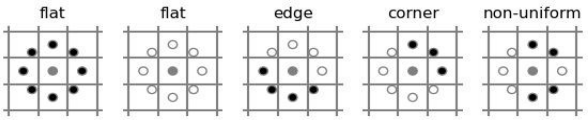
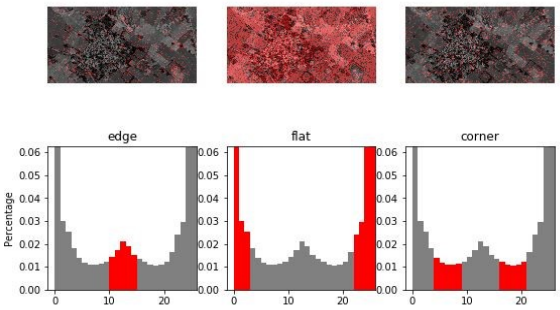
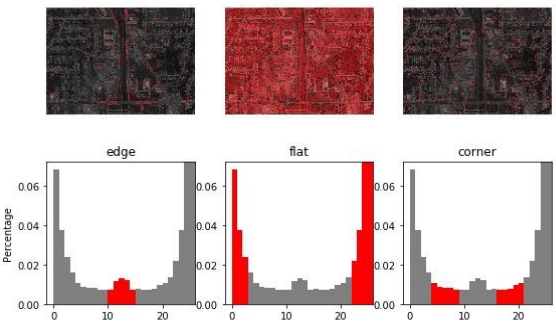


Fig.6. Illustration of LBP method

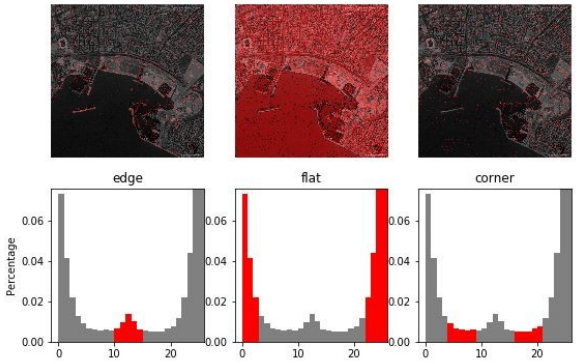
Above are the black or white sample results reflecting the pixel of image which is less than or more than the central pixel of an image. If the surrounding pixels are all black or white then the area of the image is flat. Continuous black or white pixels then the image region are corner or edge. If pixels have discontinuity between black and white pixels, then the pattern is considered as non-uniform.



Sample (a)



Sample (b)



Sample(c)

Fig.7. Feature Extraction using LBP Method

The above first row shows the edge, flat and corner region of the input data. The histogram of Local Binary Pattern shows the result of good measure to classify textures. Here the output histogram distribution results are checked out comparing to each other using Kullback-Leibler-Divergence.

F. Classification

Classification is the dividing process into a group of groups that can be achieved using structured and unstructured data. The initial phase begins with the definition of the data points groups. The classes are associated with class names or class categories. The classifications forecast the function of mapping the operations approximately to discrete output variables from input variables. The key aim is to establish the categorization under which the latest class data falls. Types of Learners in Classification:

- **Lazy Learners**- It stores the training data and awaits the completion of data processing. Classification is achieved using relative data contained in the training data. It has more time to assess as compared with eager learning.
  Eg: case-based reasoning.
- **Eager Learners**- It constructs the model of classification based on training data before the predictions are made. It takes therefore more time to practice and less time to forecast.
  Eg: Naïve Bayesian, Convolutional Neural Networks.

Convolutional Neural Network (CNN). It is very important mathematical operation in artificial neural network. CNN is used to understand characteristics, features then to classify the data with the use of image frames. There are many types in CNN and one among them is **depth wise seperable convolutional neural networks**.

CNN is mainly used because it has less number of characteristics to adjust as compared with standard CNN which can reduce overfitting. They are computationally cheaper because of the less calculations which can make more suitable for mobile applications. In a functional perspective CNN work preserving the spatial structure. It keeps the structure of the image. In CNN, an input image filter is considered hat extends the input volume to its maximum size. Because of a spatial position the dot product is determined between the filter and a chunk of an image. At each pixel the filter is oriented and complex, and calculate the dot product at each pixel. The cycle is repeated with multiple filters, where each filter searches for different template forms in the input. Convolutional neural network is a sequence of convolution layers interspersed with activation functions. A RELU activation function is used. The output of each layer is the input to the next layer. Each of the layer has many filters and each of them produce different activation functions. The filters at the earlier layer usually represent low level features and middle level filters and high level filters looks at high level features like corners and edges. So it leads from simple to more complex features. The input will be passing through the sequence of layers with convolutional layer first next it passes through RELU a non-linear filter. Samples the size of our activation map are pooled layer down. A completely connected layer is then be used as the final layer. The first layer with pooling basically divides the image into smaller pieces and the fully connected layer assembles them logically. Basically fully connected layer takes the output of convolution and pooling layer and uses logic to identify what kind of image it is.

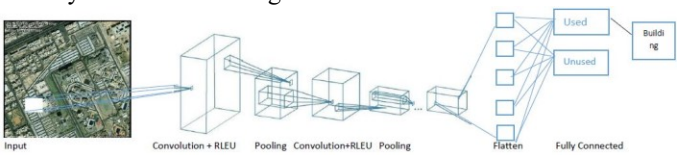


Fig.8. Working on CNN and classification of land into used and unused land.

Algorithm of CNN:

Step 1: Convolutional Operation
Step 1(b): Rectified Linear Unit Layer
Step 2: Pooling
Step 3: Flattening
Step 4: Full Connection

IV. EXPERIMENTATION RESULTS

A total of 2 datasets have been used where,

Dataset-1: A total of 1000 images as a dataset which is collected from Euro and Landsat sources. Here the 1000 images are basically divided into 10 classes which describe similar set of images that depicts a certain natural scene or an artificial setup captured through satellite. The details of the classes and the number of images are given in **Table.1.** to calculate the efficiency of system Precision, Recall and F-measures are used as performance measures. The confusion matrix is being used given in (**Fig.11.**) to calculate the accuracy of the system. The experimentation contains 2 parts of the dataset training set and testing set in order to prove the efficiency of the system done 3 trials with 50% as training unit and 50% as testing unit, 40% as training unit and 60% as testing unit, 60% as training unit and 40% testing unit respectively. The below table shows the classes and total number of images from that particular class of dataset 1:

Classes	Total number images in class
Annual crop	143
Forest	135
Herbaceous	182

Vegetation	
Highway	94
Industrial	116
Pasture	47
Permanent crop	66
Residential	88
River	41
Sea Lake	98

Table.1. Total number of images used with respect to class

Dataset-2: A total of 27 images are used as a dataset which is collected from www.satimagingcorp.com and www.isro.gov.in is another government website where satellite images are available to download where it is categorized as **Cartosat -2 Series Satellite**. It is a website where it allows downloading satellite imaging; it is archived as QuickBird Satellite Images. Using a state of the art BGIS 2000 sensor, QuickBird satellite collects the image data of 0.65m pixel resolution degree of detail. 1 image is downloaded randomly from search engine as satellite images. 1 image is downloaded randomly from Smeggie suggested website while searching in Google search engine. Here 27 image dataset is basically divided into 6 main category with 10 sub-category which describe similar set of images that depicts a certain natural scene or an artificial setup captured through satellite, the details of the classes and the number of images with respect to its sub-category are as given in **Table.2.** to calculate the efficiency of system Precision, Recall and F-measures are used as Performance measures and have done 3 trials with 50% as training unit and 50% as testing unit, 40% as training unit and 60% as testing unit, 60% as training unit and 40% testing unit respectively. The below table shows the classes and total number of images from that particular class of dataset 2:

Image Main Category	Respective sub-category and Total number of images in sub-category
QuickBird	• Sports-1 • Tourism-3 • Notable Places-2 • Historic Events-1 • Engineering and Construction-1 • Natural Disasters-1
IKONOS	• Tourism-2 • Natural Disasters-2 • Historic Events-3 • Land Record-1
SkySat-2	• Natural Disaster-1
Smeggie	• 1
ISRO	• Cartosat2 -3
Satellite images(search engine)	• Railway Station Environment-1

Table.2. Total number of sub-category images used with respect to main image category

Experimental result of Dataset-1:

Fig.9. Prediction of used area of one sample image input

Fig.10. Prediction of unused area of one sample image input

Confusion matrix

	Ann	For	Her	Hig	Ind	Pas	Per	Res	Riv	Sea
AnnualCrop	277	0	1	5	0	5	4	0	8	0
Forest	0	288	2	1	0	2	1	0	0	3
HerbaceousVegetation	3	17	243	1	0	12	14	11	0	1
Highway	7	2	1	216	8	4	5	7	19	0
Industrial	1	0	0	3	237	0	0	13	3	0
Pasture	2	9	1	1	0	163	0	1	7	3
PermanentCrop	4	2	13	4	5	6	208	7	5	0
Residential	0	0	2	1	6	0	1	303	1	0
River	1	2	1	15	3	6	2	3	211	1
SeaLake	6	5	0	0	0	5	0	0	1	258

Fig.11. Confusion matrix of classification

Classification report

	precision	recall	f1-score	support
AnnualCrop	0.920	0.923	0.922	300
Forest	0.886	0.970	0.926	297
HerbaceousVegetation	0.920	0.805	0.859	302
Highway	0.874	0.803	0.837	269
Industrial	0.915	0.922	0.919	257
Pasture	0.803	0.872	0.836	187
PermanentCrop	0.885	0.819	0.851	254
Residential	0.878	0.965	0.920	314
River	0.827	0.861	0.844	245
SeaLake	0.970	0.938	0.954	275

Fig.12. Classification report

The above report gives overall accuracy, support of the class category

accuracy			0.890	2700
macro avg	0.888	0.888	0.887	2700
weighted avg	0.892	0.890	0.890	2700

Fig.13. Accuracy of overall system of used and unused area Landscape

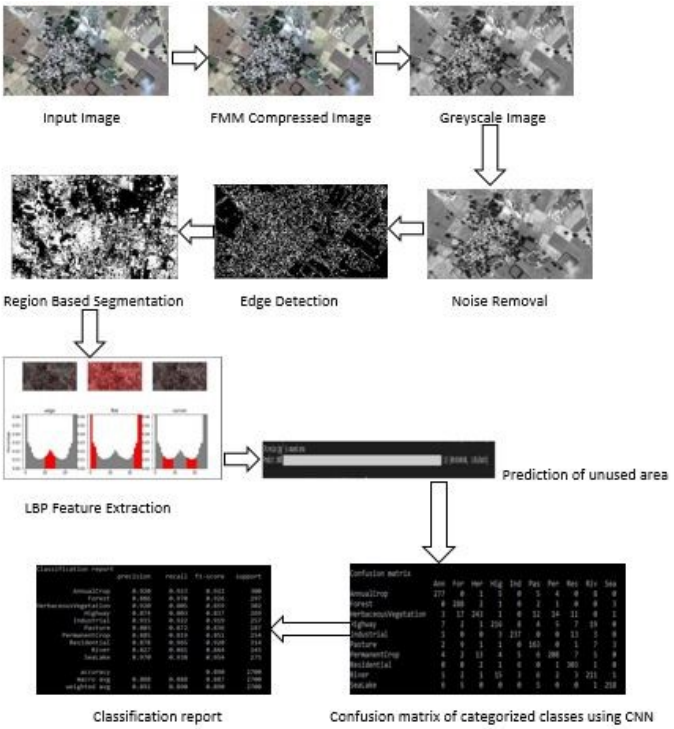


Fig.14. Depiction of complete experiment

V. CONCLUSION

As regions are not visible in the satellite imagery various pre-processing steps are performed later edge detection technique is performed for enhancing and improvising of image sharpness and making it clearer. With the help of Feature extraction technique, it helps in figuring out edge, flat and corner regions in an image. CNN is used to classify the used and unused landscape and finding the accuracy for the used and unused area of the system and it also calculates the accuracy of the overall system. The 2 sets of experimentation are performed to show the consistency of the method.

Table 3: Maximum F-Measure table obtained from CNN method

Dataset	Maximum F-Measure		
	Training : Testing Dataset (Ratio)		
	40:60	50:50	60:40
Dataset 1	87.28	89.00	90.37
Dataset 2	84.13	86.57	88.11

The above table shows that the dataset was very well

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