

# CHANGE DETECTION IN SATELLITE IMAGES USING CONVOLUTIONAL NEURAL NETWORKS

L. Ashokkumar<sup>1</sup>, J. Navarajan<sup>2</sup>, P.R. Pranesh<sup>3</sup>, P.Sanju<sup>4</sup>, B. SuryaPrakash<sup>5</sup>

<sup>1,2</sup>Associate Professor, Department of Electronics communication and Engineering, Panimalar Institute of Technology, Chennai, India

<sup>3,4,5</sup>UG Scholar, Department of Electronics communication and Engineering, Panimalar Institute of Technology, Chennai, India

\*\*\*

**Abstract:-** Geographical changes takes place everywhere within the earth. It is mandatory to monitor the changes in earth through satellite images. Currently this updating is done through manually, by updating aerial images is an expensive and time consuming process. To overcome this problem we proposed a technique to detect the changes in satellite images using neural network method. Existing method provides less accuracy and it is time consuming task. To overcome these drawbacks, we proposed a system, that uses the convolution neural network method. This neural network has been selected for this system because it performs in One-way propagation. It computes the result fast and with high accuracy. A convolutional neural network (CNN) for semantic segmentation is implemented to extract compressed image features, also on classify the detected changes into the proper semantic classes. A difference image is formed using the feature map information generated by the CNN, without explicitly training on track difference images. Thus, the proposed change detection method is unsupervised, and could be performed using any CNN model pre-trained for semantic segmentation. The final task is to classify the changes by comparing the new satellite images and previously stored information. Here, data used for this process are from database.

**Index Terms:** Convolutional Neural Network (CNN), Change Detection, Median filter, Non Local means filtering, Minimum mean square error

## INTRODUCTION

Detection of satellite images is used in global remote sensing and it is mandatory to update the collected data. Image averaging and maximization method is used in the existing system which does not produces the expected results to given input images. application of remote sensing image analysis, change detection provides an effective technical means for environmental monitoring, resource exploration, disaster relief and management. To improve the method we used convolutional neural network. It produces the proper expected results is necessary to settle on an appropriate architecture and learning algorithm.

Neural Network Auto encoder For Change Detection[1]. To study about the time Series Change

Detection Method For Landsat Land Use And Land Cover Change[2]. For improving the image resolution and quality, Change Detection For High Resolution Remote Sensing Image Based On Co-Saliency Strategy[3]. To know about ensemble Classifier, Research Of Building Earthquake Damage Object-Oriented Change Detection Based On Ensemble Classifier With Remote Sensing Image[4]. To enhance the knowledge in radar image propagation, Synthetic Aperture Radar Images Changes Detection[5]. In[6] SAR Image Change Detection Using Pcanet is studied. For implementing the sequential change detection [7] is used. To identify the change in sea ice [8]. Binning Approach To Quickest Change Detection With Unknown Post-Change Distribution is used [9]. Study about the Hyper spectral Anomaly Change Detection On Viareggio[10].

## DIGITAL IMAGE PROCESSING

The recognizing of objects from an input picture is the main thing in image processing. It includes various techniques like removal of noise, followed by that extracting feature to place lines, regions and possibly areas with certain textures. Manipulating data within the sort of a image through several possible techniques. An image is usually interpreted as a two-dimensional array of bright values, and is familiarly represented by such patterns. An image are often processed optically or digitally with a computer. To digitally process an image, it is necessary to scale back the image to a series of numbers which will be manipulated by the personal computer. A typical digitized image may have 512 × 512 or roughly 250,000 pixels, although much larger images are getting common. Once the image has been digitized, there are three basic operations will be performed within the computer. For few extent point operation, a pixel value within the output image depends on one single pixel values are in input image. For some operations, neighbor pixels are the input image to determine the value of an output image pixel. In a global operation, all the input image pixels produces an output image pixel value. These operations, taken singly or in together, are the means by which the image is enhanced, restored, or compressed. An image is enhanced when it's modified as the knowledge it contains is more clearly evident, but enhancement can be include making the

image more visually appealing. An example is noise smoothing. To smooth a noisy image, median filtering is applied with a 3 × 3 pixel window. The data of each pixel in the noisy image is recorded, together with the values of its nearest eight neighbors. These nine numbers are then ordered in keeping with size, and the median is chosen because the data for the pixel within the new image.

METHOD I

PROPOSED SYSTEM

There are four main parts in an change detection in satellite system, containing pre-processing, filtering, image fusion and classifier construction.

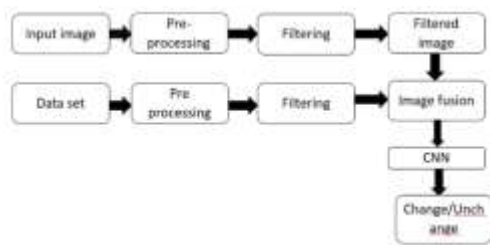


Fig 1.1 Architecture of the proposed system.

PREPROCESSING:

Median Filter is a non-linear digital filtering technique, it is widely used to remove noise from an signalled images Noise reduction is an important pre-processing step to enhance the results of later processing. The major important role of the median filter is to perform through the signal entry by entry, restoring each entry with the median of neighbouring entries. The pattern of neighbours is known as "window", which slides, entry by entry, over the signal. For 1D signals, the obvious window is simply the first few preceding and following entries, whereas for 2D (or higher-dimensional) data the window must include all entries within a given radius or ellipsoidal region. Median filters are plays major role in reducing random noise, whenever the noise amplitude probability density has large tails, and periodic patterns. The median filtering process is efficient by sliding a window over the image. The filtered image is obtained by placing the median of the values within the input window, at the location of the middle of that window, at the output image. The median is that maximum likelihood estimator of location in the case of Laplacian noise distribution. For relatively uniform areas, the median filter estimates the grey-level value, with particular success in the presence of long-tailed noise. As an edge is crossed, one side or the opposite dominates the window, and therefore output switches sharply between the values. Thus, the edge is not blurred. Median filters of both recursive and non-recursive types are considered. Recursive median filters were more efficient than those of the non-recursive type. The

median filter is that one sort of nonlinear filters. It is very effective at removing impulse noise, the "salt and pepper" noise, within the image. The principle of the median filter is to exchange the grey level of every single pixel by the median of the grey levels in a neighbour hood of the pixels, instead of using the average operation. Before beginning median filtering, zeros must be padded round the row edge and therefore column edge. Hence, edge distortion is introduced at image boundary. He nonlinear function of the median filter can be expressed as

$$Y(n)=med[x(n-k),x(n-k+1),.....x(n),....., x(n+k-1), x(n+k)]$$

FILTERING

Adaptive filtering and adaptive spectral subtraction are the methods used for single-channel speech enhancement in use today. We check with both methods collectively as filtering- based methods. The adaptive variations of the respective filter parameters of those methods is usually performed with the assistance of two essential system components: a noise spectrum estimator, such as the improved minima-controlled recursive averaging (IMCRA) algorithm proposed by Cohen or the minimum statistics algorithm by Martin an a-priori signal-to-noise ratio (SNR) estimator, such as the decision-directed approach by Ephraim and Malah Filter gains are determined through short time spectral amplitude (STSA) estimators or the log spectral amplitude estimator (log-MMSE) or other suitable mappings. In filtering techniques, the standard of the resulting enhanced signal depends on the SNR and STSA estimate. Development of adaptive SNR and STSA estimators have, therefore, received a huge amount of attention within the research community.

Non Local means filtering

Non-local means filter is an algorithm in signal processing for denoising. Unlike other local smoothing filters, non-local means filter averages all observed samples to recover a single sample. The weight of each pixel depends on the distance between its intensity grey level vector and that of the target signal sample. The NLM filter is predicated on the assumption that image content is probably to repeat itself within some neighbourhood (in the image) and in neighbouring frames. It computes denoised sample  $x(p, q)$  by the weighted sum of the encompassing pixels of  $Y(p, q)$  (within frame and in the neighbouring frames). This feature provides a unique way to estimate the signal sample value from noise contaminated signals. In a NLM algorithm, the estimate of a pixel at position  $(p, q)$  is

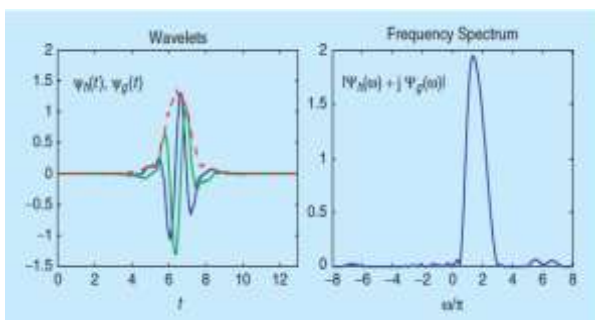
$$x(p, q) = \frac{\sum_{m=1}^M \sum_{(r,s) \in N(p,q)} Y_m(r, s) K_m(r, s)}{\sum_{m=1}^M \sum_{(r,s) \in N(p,q)} K_m(r, s)}$$

**Log-MMSE Filtering:**

The problem is discussed in generally than in many other expositions specifically that yield for general filter delays (to accommodate the pitch filtering problem, for instance) and it maintains both the stochastic case and block-based analyses with one formalism. For mean-square error computations, we need to use at the most second order statistical properties (correlations and means). For the case of stochastic signals, the derivation of the correlation values need for a minimum mean-square error solution. To examine systems which involve cyclo stationary signals (interpolation filter, for instance). The important linear prediction problem is examined intimately. It includes the setup for non-equally spaced delay values. For the equally spaced delay case, it can able to develop a upscale set of results. For the least-squares problem, these notes provide a generalized view of windowing: windowing the information and/or windowing the error. This view subsumes the quality special cases, viz the auto correlation and covariance methods. It present a variety of examples based on “real” signals. With the background developed, the results are obtained with relatively straightforward MATLAB scripts. The results illustrate the useful insights that would be obtained when minimum mean-square error theory is appropriately fleshed out. Consider a filter with an input  $x[n]$  and an output  $y[n]$  given by

$$y[n] = \sum_{k=0}^{M-1} w_k^* x[n - D_k],$$

Where the  $W_k$  values1 weight the samples of the input signal at different delays  $D_k$ . We require that the delays be distinct.



**Fig:1.2** A q-shift complex wavelet corresponding to a set of orthonormal dual-tree filters of length

**Image Fusion:**

Image fusion is that the process of mixing relevant information from two or more images into one image. Image fusion techniques are widely utilized in various applications like remote sensing, medical imaging, military and astronomy. Image fusion may be a process of mixing two or more images to enhance the knowledge content. Image fusion techniques are important because it improves the performance of visual perception systems by integrating many sources of satellite, airborne and ground based imaging systems with other related data sets. Further, it also helps in sharpening the pictures, improve geometric corrections, enhance certain features that aren't visible in either of the pictures, replace the defective data, complement the info sets for better deciding . It combines the many information from two or more source images into one resultant image that describes the scene better and retains useful information from the input images. A high resolution panchromatic image gives geometric details of an image due to the presence of natural also as manmade objects within the scene and a coffee resolution multispectral image gives the color information of the source image. The aim of multi sensor image fusion is to represent the visual information from multiple images having different geometric representations into one resultant image with none information loss. The benefits of image fusion include image sharpening, feature enhancement, improved classification, and creation of stereo data sets. Multi sensor image fusion provides the advantages in terms of range of operation, spatial and temporal characteristics, system performance, reduced ambiguity and improved reliability.

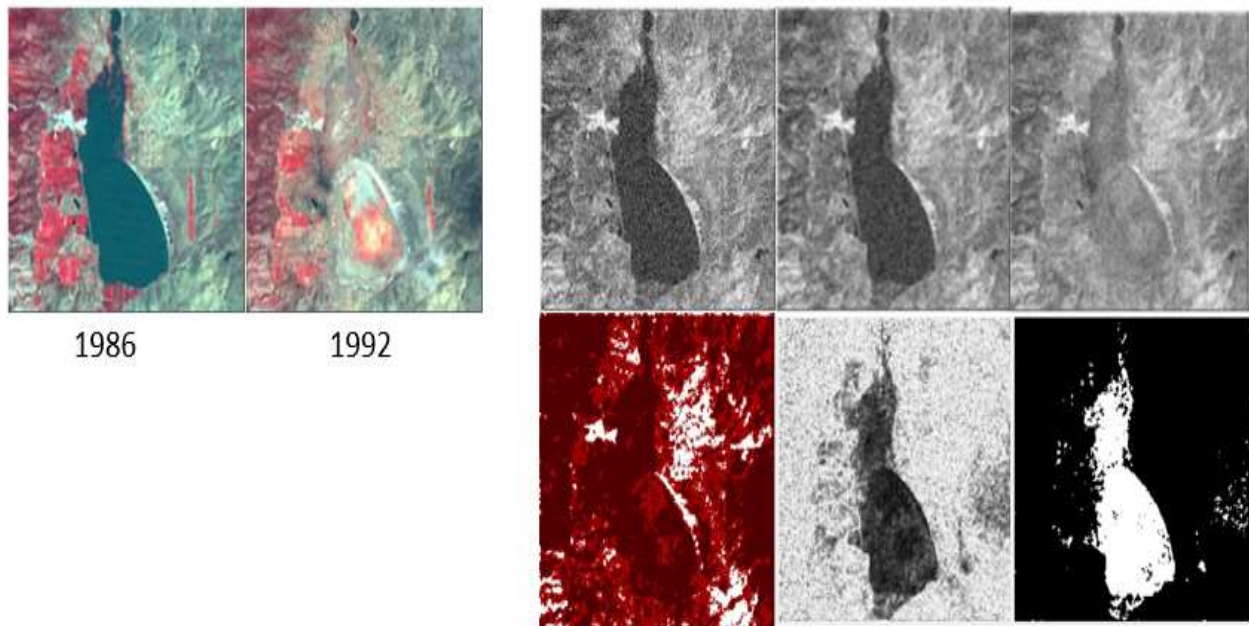
**CONVOLUTION NEURAL NETWORK:**

Artificial Neural Networks are utilized in various classification task like image, audio, words. To get the best results using the neural network, it is necessary to settle on an appropriate architecture and learning algorithm. Based on the research in previous research papers, suitable consistent method is used to expand or shrink the neural network size until a reasonable output is obtained. In this work we tried different sizes for the neural network using python and we found that the best among them. Different kinds of Neural Networks are used for various purposes, for example for predicting the sequence of words we use Recurrent Neural Networks more precisely an LSTM, similarly for image classification we use Convolution Neural Network .This algorithm will detect the changes in geographical area and it differentiate the places in the images. The entire network has a loss function and all the ideas and tricks that we developed for neural networks still apply on CNNs.

## RESULT AND ANALYSIS:

The qualitative detection results are shown in Fig including multi feature combination and image fusion comparison strategy. Simultaneously, the qualitative results are also displayed. The accuracy of multi feature combination is lower than the image fusion strategy in

adopted dataset. The proposed strategy obtains an acceptable result which reach on 91.63% 84.56% and 81.53% respectively ,although there exists some error regions as well. It is seem the case that several small regions have been lost in the process of difference image generation.



**Fig 1.3 Qualitative comparison of change detection in maps.**

## CONCLUSION

In this paper , we implemented image fusion method for high resolution images has been proposed using a such strategy. Meanwhile the experiment have verified the effectiveness ,compared with multi feature combination approach. Both quantitative analysis indicate that the algorithm is suitable for high resolution image change detection. The method will be improved based on implemented method in the future work.

## REFERANCES:

- [1] Neural Network Auto encoder For Change Detection In Satellite Image Time Series, Ekaterina kalinicheva, Jeremie Sublime And Maria Trocan, IEEE 2018.
- [2] A New Time Series Change Detection Method For Landsat Land Use And Land Cover Change, Yukun Lin,Lifu Zhang And Nan Wang, IEEE 2018.
- [3]Change Detection For High Resolution Remote Sensing Image Based On Co-Saliency Strategy , Qingle Guo And Junping Zhang,IEEE 2019.

- [4] The Research Of Building Earthquake Damage Object-Oriented Change Detection Based On Ensemble Classifier With Remote Sensing Image , Zhao Yan Ren Huazhong Cao Desheng, IEEE 2018.

- [5]Synthetic Aperture Radar Images Changes Detection Based On Random Label Propagation” Junjie Wang, Feng Gao, Junyu Dong, Shengke. Wang“ IEEE 2017.

- [6]Sar Image Change Detection Using Pcanet Guided By Saliency Detection, Mengke Li, Ming Li, Yan Wu, Wanying Song, And Lin An, IEEE 2017.

- [7] Multisensor Sequential Change Detection With Unknown Change Propagation Pattern, Mehmet Necip Kurt Xiaodong Wang , IEEE Transactions On Aerospace And Electronic Systems Vol. 55, No. 3 June 2019.

- [8] Sea Ice Change Detection In Sar Images Based On Collaborative Representation, Yunhao Gao, Feng Gao, Junyu Dong, Shengke Wang, IEEE 2018.

[9] A Binning Approach To Quickest Change Detection With Unknown Post-Change Distribution, Tze Siong Lau And Wee Peng Tay, IEEE 2018.

[10] A Study For Hyperspectral Anomaly Change Detection On Viareggio 2013 Trial Dataset", Chen Wu, Bo Du, Yukun Lin And Liangpei Zhang,"IEEE 2019.