A Review on Satellite Image Processing to Detect Buildings

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Abstract – *The Development of Land is very important for urban planning and its management, so the building detection plays a very important role in the field of earth observation. The idea is to measure the changes that happen in land use over a time as an economic indicator. Building detection from satellite images is becoming very popular. The very high resolution satellite images give significant data to researchers. Among these, urban-area boundaries and building location are important. For a human expert, manually extracting this valuable data is tedious, so to extract this data we need to use some automated techniques that can give accurate detection of buildings and its location. This can be done by applying image processing techniques on the satellite images of urban areas. This helps to monitor the rate of urbanization, state cadastral inspection, infrastructure development and city planning. In this article the study of various building detection techniques is presented.*

Key Words: **Building Detection, Image Processing, Satellite Images.**

1. INTRODUCTION

The satellite imagery domain is an important asset of information, which when used completely can give significant bits of knowledge for us to analyze. Examination on satellite pictures can be performed to detect buildings, monitor oil, detect vegetation land, and many more. Urban area detection in remote sensing images is valuable in national development and land investigation. To begin with, urban area detection can indicate buildings in cities effectively, as a precondition for urban checking. It would be useful for government agencies and region planners to update the data and formulate planning. Besides, urban area detection fills the need of urban change recognition, advanced mapping, and military surveillance.

Automatic and real-time detection of large urban regions is possible because of the wide area inclusion by remote sensing. Building detection from satellite imagery data is a fundamental but a difficult issue because it requires correct recovery of building footprints from high-resolution images. Various customary techniques have been proposed to identify urban regions and buildings. A portion of these techniques rely upon the structure and surface qualities of remote sensing images.

2. RELATED WORK

This section gives the complete details of researches and their work regarding the existing techniques of Pre-processing, feature extraction and Classification Techniques. Some of them are explained below.

Yanfeng Wei et al., [1] they have proposed an algorithm to detect urban buildings from high resolution panchromatic QuickBird images using edge detection and clustering. Unsupervised clustering by histogram peak selection is utilized to partition the picture into various classes. Then to verify the buildings the shadows are used as one of the evidence. So that the individual buildings are extracted from the building clustering class with the exception of the shadow class. For removing the presence of the false objects of the buildings and to detect the correct building boundary the canny operator is applied to get the edges of the building objects in the panchromatic image. Then Hough transform is used to get the polygon structure of the building.

Beril Sirmacek et al., [2] they have proposed a novel approach for building detection using multiple cues. By using the invariant colour features the segmentation of aerial images is done. Then by the information of edge and shadow the building is detected.

Lior Weizman et al., [3] segmented the urban areas by utilizing the idea of visual words it depends on building a "dictionary" of small patches, which appear in the urban areas. The algorithm is based on a new pixel-level variant of visual words and consists of three sections, building a visual dictionary, learning urban words from marked pictures, and detecting urban regions in a new image.

B. Sirmacek et al., [4] they have proposed an algorithm to detect the urban area and buildings in satellite images by using the concept of scale invariant feature transform (SIFT) and graph theoretical tools. The SIFT keypoints are very good in distinguishing objects under different imaging conditions, but these are not sufficient for identifying the urban areas and buildings alone. So they have used the concept of graph theory in which each keypoint is indicated as the vertex of the graph so the relationship between theses vertices lead to the edges of the graph. Based on this formalism, the urban region is separated by utilizing a novel numerous subgraph coordinating technique. Then the extraction of the separate buildings is done by using the graph cut method.

C. Senaras et al., [5] proposed a novel way to deal with building detection issue in satellite images. This technique uses the two-layer hierarchical classification mechanism for ensemble learning. In this each portion is ordered by N various classifiers utilizing various highlights at the primary layer. The class membership values of the portion are taken from different base layer classifiers to form a new fusion space which later forms a linearly divisible simplex. So that the simplex is further divided by linear classifier at the meta layer.

C. Tao et al., [6] they overcame the problem of high-resolution of remote sensing images covering different scenes, so they proposed an unsupervised approach to extract the built-up areas. They used Harris corner detector to extract an enormous arrangement of corners from each input picture. To find the candidate regions in each input image they incorporated the extracted corners into a likelihood function. By using the set of candidate built-up regions, the issue of built-up regions detection was overcoming by an unsupervised grouping problem. By the use of spectrum clustering and graph cuts the texture histogram and the grouping problem of candidate region was solved.

S.Kala et al., [7] they have proposed a novel Tetra wavelet method to provide the solution for building detection. This method handles the tetra images which are derived from the original grayscale image. Likewise, it also handles the pixel value in middle of 0 to 3 which is additionally as far as tetra. The Tetra wavelet method approaches wavelet procedure which is built by the XOR operation. Then eight component connectivity method controls the final building detection to improve the segmentation accuracy.

Andrea Manno-Kovacs et al., [8] they have proposed a methodology for building detection from a single very high resolution optical satellite images by combining the information of shadow and urban territory data. The benefits of graph cuts provide a thorough answer for automatic building detection, a flexible multi-label dividing technique is proposed in which the quality of enhanced classes is automatically chosen by the substance of a scene of interest.

Kan Tang et al., [9] they have focused on high-rise buildings in complex urban situations. The particular attributes of high-rise building in high resolution SAR images are analyzed. The contextual data of bright line features is indicated as corner lines and double bounce to extract the textural feature of the periodic patterns showing in the layover area. Then a new algorithm is proposed for high-rise building detection from single SAR images to gather the building information.

Prajowal Manandhar et al., [10] they have proposed a methodology to identify buildings in very high resolution satellite images of urban areas. They have used One-Class support vector machine (SVM) to determine human made structures. To extract the buildings, the texture segmentation approach utilizes a conditional threshold value. To extract the bright foreground objects they have used the geodesic opening and closing activities. By using the spectral properties, the shadows and vegetation region are detected. Then remove noise, vegetation and shadow from the building region.

Huijun Chen et al., [11] they introduced a new method of building indicator found on multi-angle images and angular difference feature(ADF) which describes angular properties from ZY-3 multi view images. The ADF include feature extraction and a post-processing venture to refine the outcomes by at the same time consolidating the spectral and geometrical data.

Geesara Prathap et al., [12] they proposed an algorithm for the building detection by using deep learning approach. They pre-processed the data by 2-sigma percentile normalization. Then ensemble modelling is included the data preparation in which 3 models are created while incorporating Open StreetMap data. For the improvement of the data labelling process the Balance Distance Transformation is been used and by the addition of batch normalization wrappers the U-NET can be modified. They have also shown how each part of the methodology is associated with the final detection accuracy.

Evangelos Maltezos et al., [13] To classify the buildings structures from the vegetation they have augmented the raw LiDAR information with features which are originating from a physical interpretation of data. They have proposed deep learning paradigm dependent on convolutional neural network model to get the best input representations which are good in classification.

Shunping Ji et al., [14] They proposed Siamese fully convolutional network model to achieve better segmentation accuracy. Building dataset had both the aerial images and satellite images which covers both the raster labels and vector maps. They also proposed Siamese U-Net with weights shared in two branches. For multi-source building extraction a radiometric augmentation strategy is used to transfer the pertained models on the aerial dataset to satellite dataset.

3. CONCLUSION

In this paper we have explained various techniques for automatic building detection from satellite and aerial images. It has been observed that in each technique the accuracy varies. Each technique is trying to achieve better accuracy. If the Accuracy is good than small buildings also will be detected which will be helpful in various urban applications.

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