AUTOMATED URBAN ROAD DETECTION IN HIGH-RESOLUTION SATELLITE IMAGES WITH MACHINE LEARNING

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ABSTRACT_The automatic road extraction in metropolitan areas from high resolution satellite pictures is the main topic of this work. We suggest a novel, machine learning-based strategy. First, a large number of features that reflect the properties of the road are retrieved, including the ratio of light sections, the consistency of the direction of the edges, and local binary patterns. Then, AdaBoost is used to train classifiers and choose the most useful features once these features have been entered into a learning container. Last but not least, utilising the learning outcomes, roads are spotted with a sliding window and validated by integrating the road connectivity. The efficacy and reliability of the suggested strategy are demonstrated by experimental findings on actual Quickbird photos.

1. INTRODUCTION

Street extraction in metropolitan regions has been a significant undertaking for producing geographic data frameworks (GIS). Particularly lately, the quick advancement of metropolitan regions makes it pressing to give cutting-edge guides. The convenient street data is exceptionally helpful for the leaders in metropolitan preparation, traffic the executives and vehicle route fields, and so on. These days, we are encountering a blast in how much satellite picture information, which gives us bountiful information and furthermore carries difficulties to the street extraction task simultaneously. Manual road extraction methods are time-consuming and laborious, and they are unable to meet the growing demand for such a large amount of data. Consequently, it has drawn extensive consideration of numerous scientists on the most proficient method to foster programmed street extraction frameworks. Also, much work has been finished for this assignment. In digital photogrammetry and computer vision, however, the problem of automatically extracting urban roads from high-resolution remote sensing imagery remains a challenging one. The principal reason is that the assorted street surfaces and the

complex general conditions, for example, trees, vehicles and shadows prompted by high structures make the metropolitan streets take on various surfaces and dark levels in pictures

2. LITERATURE SURVEY

G. Kumar, D. Murgan, et.al (2018) have used Otsu method and genetic algorithm to detect road from satellite image. The empirical evaluation of two algorithm suggested that genetic algorithm is capable for extracting majority of road network and get better result. The presence of bushes and tree decreases the accuracy of result. The algorithms would cluster trees that are very close to each other, causing an error in the final detection of roads.[3]

P.Yadhav and S.Agrawal (2018) used the Outs segmentation method to extract roads. They also employed connected component analysis and morphological operation. The obtained result includes road extraction and detection. This methodology, however, was unable to remove areas connected to the road network.[4]

The road was extracted and detected using an adaptive global threshold and a high-resolution satellite image by Pankaj Pratap Singh and R.D. Garg (2013). By employing specific morphological operations, reduce the detection of the aforementioned pixels to a minimum. The method is based on the pixel's intensity values, which lead to the detection of some unwanted objects. It eliminated the non-segment area by employing a road tracking algorithm. Rightness and fulfillment upsides of value appraisal boundaries are determined as 96.52 and 95.32 separately, which show level of street network extraction. Nonetheless, now and again misclassification happen, for example, infertile land and stopping regions and delegated road5]

Berilsirmac,ek and cemunsalan (2010) has removed and recognize the street by utilizing watchful edge framing the spatial democratic framework and following. Six different iksons-like images are used to test the road network extraction method. The road network has a total length of 12608 pixels in these test images. Jiuxiang Hu, AnshumanRazdan, et al. (2007) proposed the method for extraction of road network and intersection detection from aerial image by tracking footprint. The method was able to detect without applying the tracking step 78.85[6]. The road tree pruning approach effectively trims the paths that leak into the road surroundings, significantly improves the performance of our road tracker, and increases the correctness and quality of the results that are obtained in this study. To

identify the intersection of a road and extract the inscribed lines of the road network, an adaptive unsupervised approach was used. 7] He Youquan, QiuHanxing, and Wang Jian et al. (2011) proposed a mathematical morphology-based method for crack image road detection. A mathematical morphological method is used in this paper to identify the road crack from the image. This technique is primarily used for pre-segmentation image repair and pruning of crack road images. It does a good job of reducing noise, but it also extracts the edge of the image in a clear and precise way and repairs image edges that have been damaged by noise. Not only does it remove the edges of cracks with clarity and precision, but it also effectively muffles the noise. 8] Using laser imaging, X. Yu and E. Salari proposed a method for detecting pavement potholes and determining their severity. An image processing module for removing regions of laser color from an image is included in this paper. A different image processing technique was used to detect potholes using a laser pattern following the extraction of the laser line for deformation.[9]

2. PROPOSED SYSTEM

The AdaBoost machine learning technique is used by the author in this research to extract roads from satellite pictures. The QuickBird satellite image dataset is being used by the author to train AdaBoost, and several feature extraction techniques, including Canny Edge Detection, Hough Line, and LBP, are being used to extract features from the images. These extracted features are then input to AdaBoost for learning or training a model. Since AdaBoost was trained on straight-line features, it can predict straight-line roads from any test image when used to extract roads from satellite images.

3.1 IMPLEMENTATION

To implement this project we have apply following techniques

1) Input images: using this module we will input satellite images

2) Canny Edge Detection: using this method we will extract edges from images

3) Hough Transformation: if extracted edges contains straight line then we got road in input images and then extract features

4) LBP: Extracted features will be input to LBP algorithm to extract out road lines from images

5) AdaBoost Learning: extracted LBP features will be input to AdaBoost algorithm to train a model.

6) Road Extraction: AdaBoost trained model will be applied on test image to get road

To implement this project we have

designed following Modules

1) Upload Satellite Images Dataset: using this module we will upload satellite images dataset to application

2) Run Canny, Hough & LBP Features Extraction Algorithms: using this module we will read all images and then extract features using Canny, Hough and LBP

3) Train AdaBoost Algorithm: using this module we will input extracted features to AdaBoost algorithm to train a model

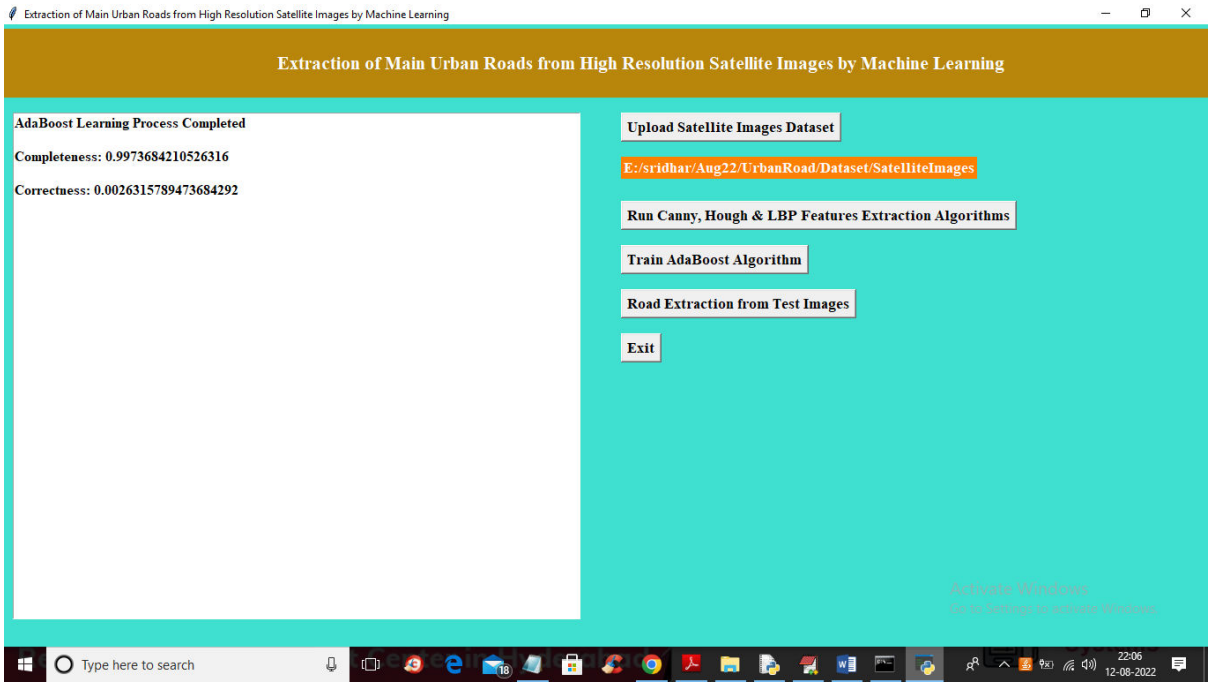
4) Road Extraction from Test Images: using this module we will input test image and then AdaBoost will learn and extract road from given satellite images

3.2 Adaboost Algorithm

Boosting is an ensemble learning method that transforms a group of weak learners into strong learners in order to reduce training errors. Boosting involves selecting a random sample of data, fitting it with a model, and then training it sequentially. That is, each model attempts to compensate for the shortcomings of its predecessor. Each iteration combines the weak rules of each classifier to form one strict prediction rule.

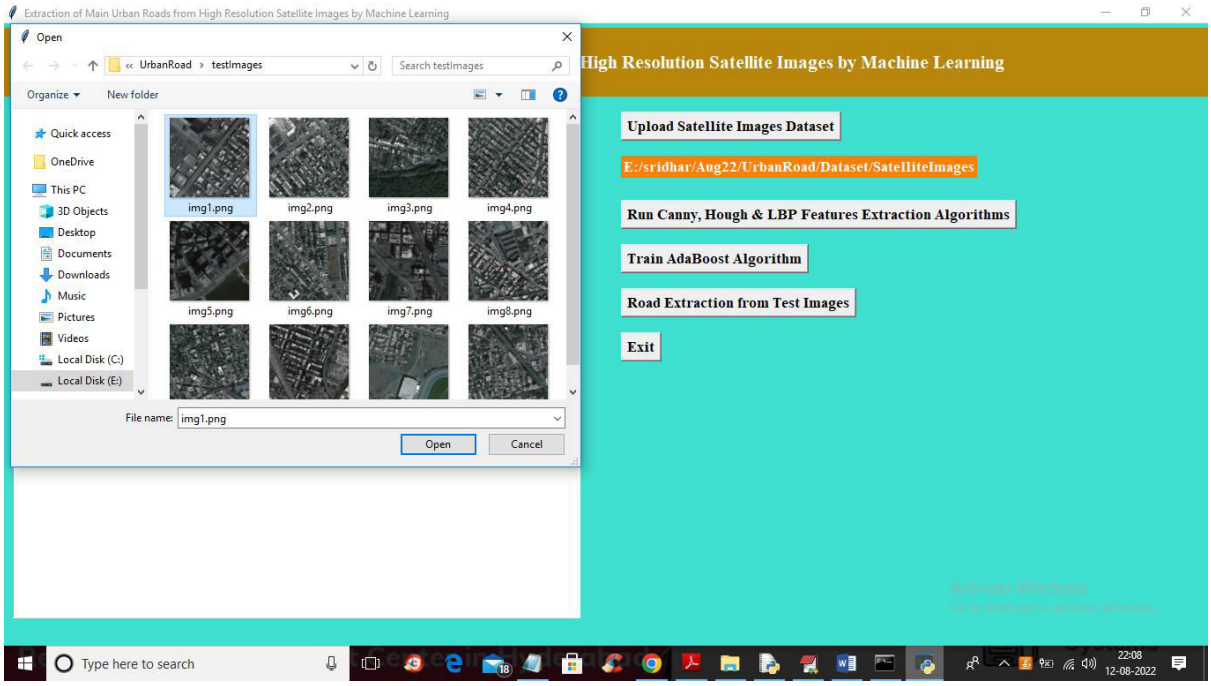
Boosting is an effective algorithm for transforming a weak learner into a strong learner. They predict using the concept of the weak learner and strong learner conversation, weighted average values, and higher vote values. For processing, these algorithms employ decision stamps and margin-maximizing classification

3. RESULTS AND DISCUSSION

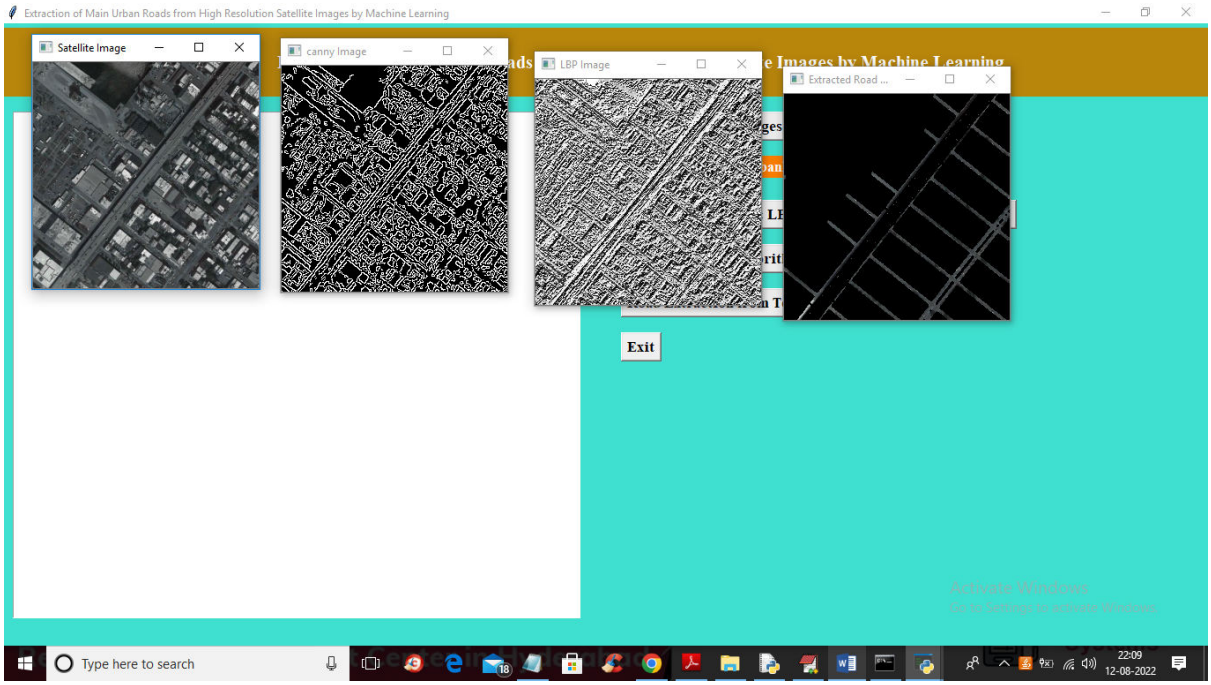


In above screen AdaBoost training completed and we got Completeness (refers to correct

prediction %) value as 0.99% and we got Correctness (wrong prediction %) as 0.0026 and now click on 'Road Extraction from Test Images' button to upload Satellite image and then AdaBoost will extract road from it



In above screen selecting and uploading 'img1.png' file and then click on 'Open' button to get below output



In above screen first image is the uploaded Satellite image and second image is Canny Edge detected image and 3rd image is the LBP image and in LBP image we can see straight ROAD

line clearly and this line will extract by AdaBoost and give output as 4th image and in 4th image we can see extracted road clearly and in 4th image we can see small white colour dots as vehicles. Similarly you can upload and test other images

4. CONCLUSION

Road detection and extraction from multispectral satellite images has been considered an essential area of research in remote sensing and computer vision. Road detection and extraction is more effective in rural areas than urban areas where man-made objects are less and possible to detect road more easily, and minimized the human labour in some extent. In this study, we proposed an efficient road extraction method that can successfully extract road from multispectral satellite images having different size and shape with minimal human intervention. The effect of the input road performance parameters for neural network high resolution satellite tested on multispectral image. The Adaboost algorithm was introduce with different size of hidden layers equipped with different iteration to avoid overtraining issues. Proposed methodology can be further used to extract other natural and man-made object from multispectral satellite images.

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