DEVELOP AN AUTOMATIC ROAD NETWORK EXTRACTION SYSTEM FROM REMOTE SENSING IMAGES

A

Thesis

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Patel Miralben Jerambhai

Enrolment No. 190156004

Under the Guidance of

Dr. Ashish M. Kothari

Department of Electronics and Communication Engineering

ATMIYA UNIVERSITY,

Yogidham Gurukul, Kalawad Road,

Rajkot–360005, Gujarat (India)

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Summary

Introduction

In recent years, both the development of high resolution satellite images and the amount of available aerial images have expanded and accessible easily. Analysis of these data is now absolutely necessary. Unfortunately, the technologies used to analyze all of these images have not kept pace, so a large portion of the job is still done manually by humans, which is costly, time-consuming, and error-prone. Due to these factors, there is a strong need for efficient and dependable techniques that can automatically analyze remote sensing images.

Chapter 1 : Introduction

The organization of the thesis is as follows: chapter 1 covers the introduction of the deep learning methods. Initial portion of this chapter is discussed of convolution neural network which is foundation of most of deep learning based methods. Then after activation functions, basics of neural network, optimizers, and various semantic segmentation architectures were covered.

Chapter 2: Literature Review

The numerous prevailing road network extraction approaches for the segmentation are reviewed in chapter 2.The detailed literature review of the various road extraction techniques from RS images is covered in Section 1. The section 2 contains inferences drawn from the literature review. The problem statement is presented in Section 3, and the contribution of the thesis is covered in Section 4. Finally, section 5 discusses the goals of the two alternative approaches.

Chapter 3: Modified U-Net

Chapter 3 portrays the proposed novel approach for semantics segmentation by Modified U-Net. U-Net architecture is used to do semantics segmentation from HR RS images for Road Network. As this architecture takes more time to detect the image and train the method on the dataset. Therefore a novel modified U-Net approach is proposed that has lesser number of CNN layers that cause the faster train the model on the dataset as well as fast extract the images from HR RS images. The organization of the chapter 3 is as follows. Section 1 covers the proposed Modified U-Net method , section 2 describe the results and discussion of the

proposed method, section 3 represent the experimental setup and finally section 4 include the applicability analysis of the modified U-Net with other well known existing methods.

Chapter 4: Gradient Descent Sea Lion Optimization

A hybridization of SGD and SLO named as GDSLO newly designed optimizer is covered with implementation and results in the chapter 4. In this method, Firstly input is pre-process to remove the noise from the input database. Then after road region detection is performed on the pre –processed images. Finally FCN is used to detect road edges and road centerline from road segmented output. The organization of this chapter is as follows. The GDSLO method is covered in Section 1, the results and discussion are presented in Section 2, a comparison of other approaches is discussed in Section 3, and the experimental results are shown in Section 4.

Chapter 5: Conclusion and Future Scope

Finally, chapter 5 is the conclusion and future scope of thesis.

The review of the results of these various approaches is presented here briefly as below.

- The modified U-Net can effectively segment road images from the remote sensing images. The average value of IoU and Dice score of segmentation occurred at 93.74 %, and 93.28 % respectively during training of the module. During the testing phase, the average value of IOU and DICE scores occurred at 92.19 % and 92.68 % respectively. The training time required for the road network segmentation model was 1.34 hr and the testing time for a single image was 0.3 sec.
- The dataset could be effectively augmented by the rotate and flip method. This could alleviate the over fitting caused by the lack of training samples.
- The results showed that the accuracy of the modified U-Net was higher than that of other algorithms as well as the speed of the detection of the image was relatively high.
- GDSLO algorithm used for road surface, edges and centerline extraction by use of newly developed optimizer based on combination of SLO and SGD algorithm. After extracting road surfaces, road edge detection is done using FCN for extracting single-pixel width boundaries of Roads and Road centerline detections is perform using FCN for detection of the road network from high resolution RS images.

- Furthermore, the developed GDSLO-based U-Net outperformed numerous existing methods and achieved effective performance by considering precision, recall, and F1-measure with maximum values of 0.887,0.930,and 0.809, respectively.