EXTRACTION OF POST-EARTHQUAKE BUILDING DAMAGE INFORMATIOM BASED ON CONVOLUTIONAL NEURAL NETWORK

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1.Objectives

The seismic damage information of buildings extracted from remote sensing (RS) imagery is meaningful for supporting relief and effective reduction of losses caused by earthquake. The objective of this paper is proposing a stratagem that object-oriented and CNN are combined to extract the information of damaged buildings from remote sensing image.

2.Methodology

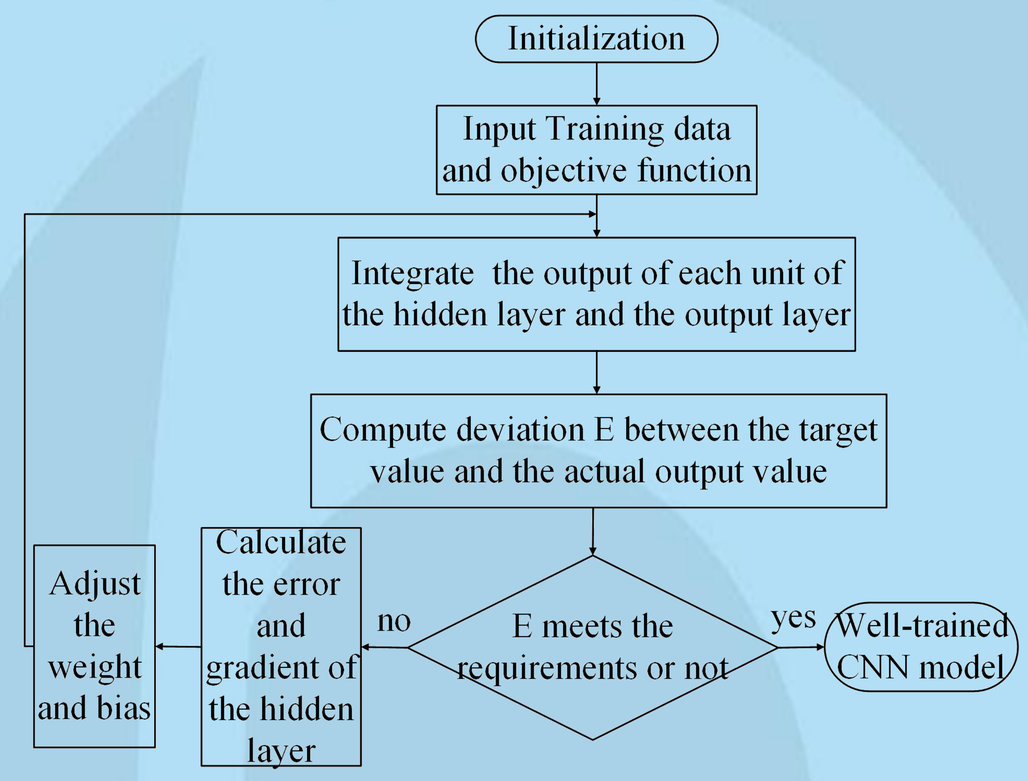

Figure 1. The training process of CNN model

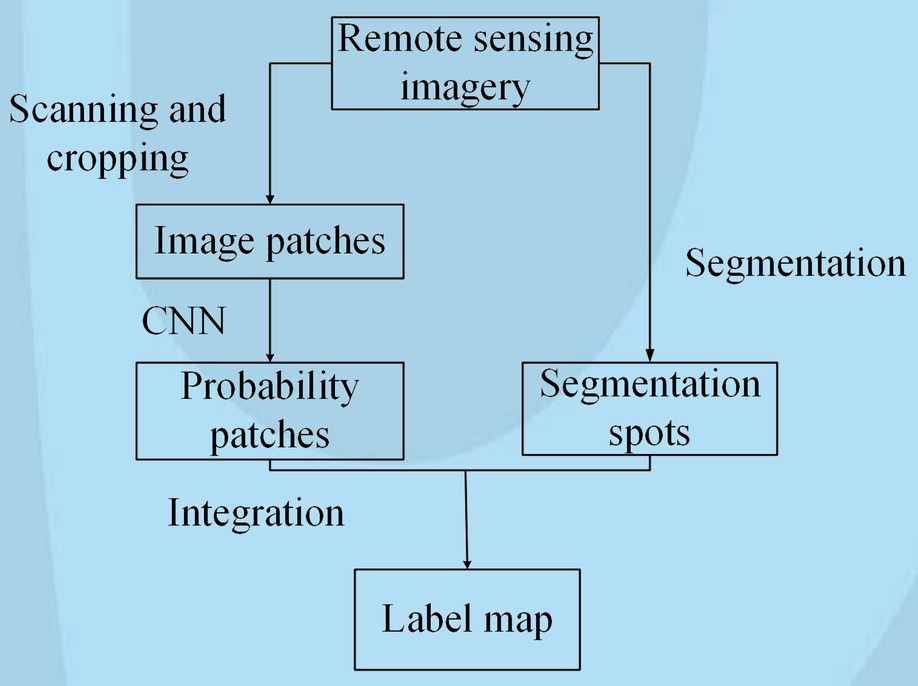

Figure 2. Workflow map of object-oriented and CNN method (modified from Yuanming Shu, 2014)

The basic idea of the method is training CNN, segmenting remote sensing imagery, using well-trained CNN to predicate pixel's probability and combining segmentation spots and probability map to integrate the category of every segmentation spots.

3. Study Area and RS data

A destructive earthquake with Ms6.5 occurred Aug. 3, 2014 in Ludian County (27.1° N, 103.3° E), Yunnan, China. Part of the seriously stricken Longtoushan Town, Ludian is selected as experiment area by using post-earthquake aerial image with area of about 12 km^2 and resolution of 0.3m. Some collapsed and uncollapsed buildings are found in the imagery.

4.Experiment and result

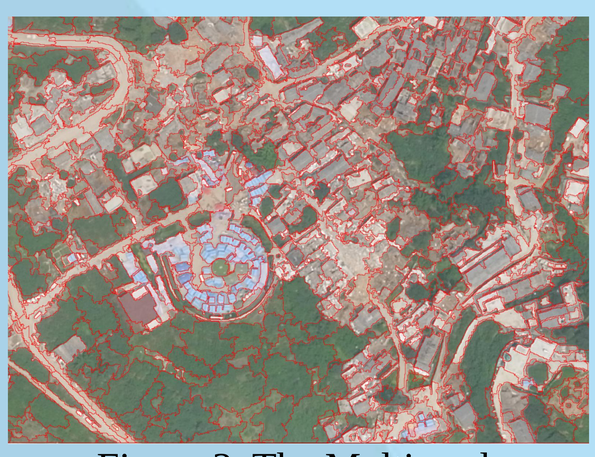

Figure 3. The Multi-scale segmentation of remote sensing imagery

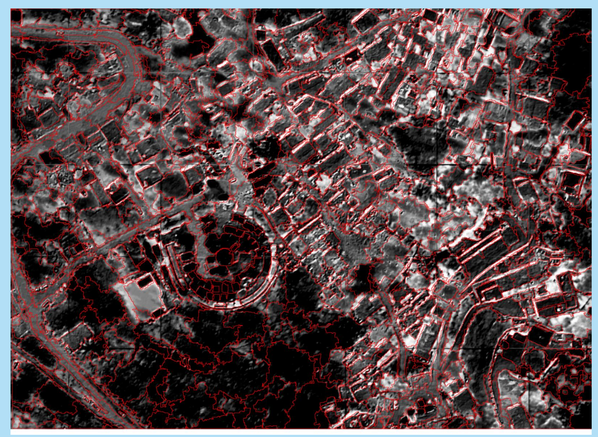

Figure 4. The probability of uncollapsed-building overlay the boundary of segmentation spots

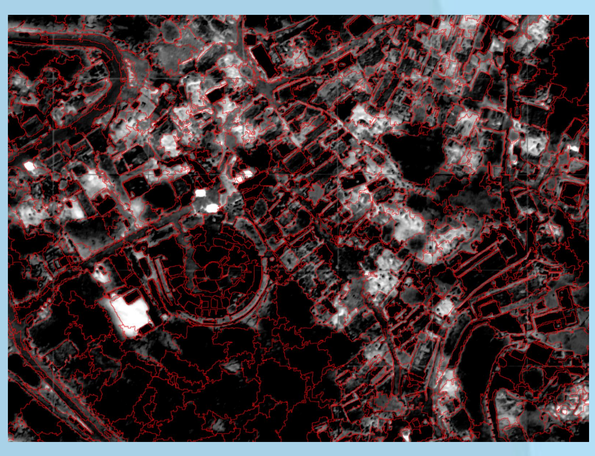

Figure 5. The probability of collapsed-building overlay the boundary of segmentation spots

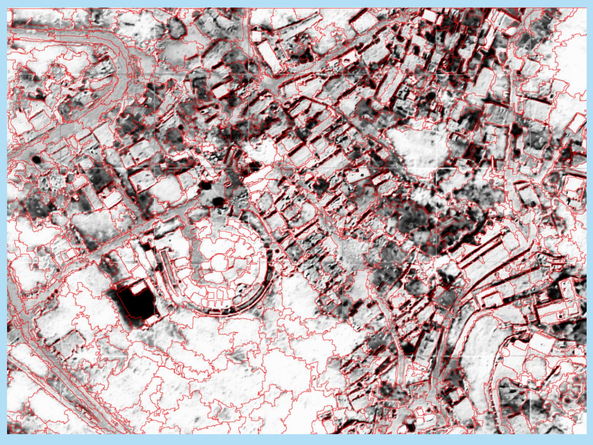

Figure 6. The probability of other objects overlay the boundary of segmentation spots

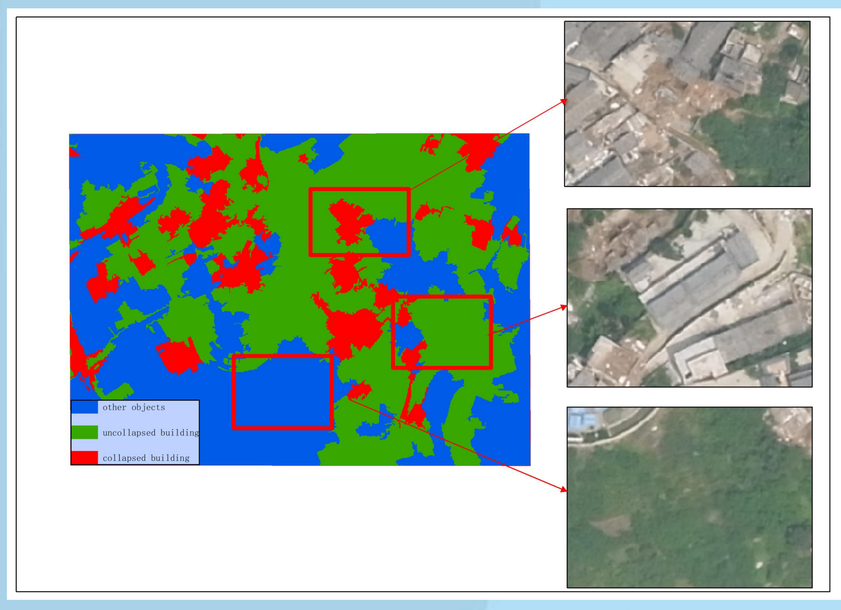

Figure 7. the result map and a part of the original remote sensing imagery

The result is compared with the visual interpreted one to verify the accuracy of this method. The overall accuracy is 0.93, Kappa is 0.86, which show a good classification result.

5.Dicussion and conclusion

From the experiment and its result, it is concluded that the method of combining CNN and segmentation can be used to extracting collapsed and uncollapsed buildings. But there still exists some defect comparing the extracted building damage map with the ground-truth map. Firstly, some bare soil or un-collapsed buildings are classified as collapsed buildings and vice versa. Secondly, some collapsed buildings are not extracted. The reasons can be summarized as following: firstly, the number of training data is too small, what's more the ground truth map may have error; secondly, the collapsed buildings and the bare land are easy to be confused, because both of them have similar spectral signature.

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