

# The application of video and Image recognition technology with neural network to conservation biology

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博士論文（要約）

**The application of video and image  
recognition technology with neural network  
to conservation biology**

（ニューラルネットワークを用いた  
動画像認識技術の生態系保全への適用について）

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東北大学大学院 生命科学研究科

生態システム生命科学専攻

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To achieve the goals of conserving ecosystem and biodiversity, it is becoming important to develop management tool by implementing new technology. The cost reduction, downsizing and energy saving of electronic devices have enabled large-scale and wide-ranging surveys using technology such as remote sensing. The improvement of the computing performance has enabled the processing and extracted significant information from obtained big data. This trend is expected to continue in the future, and it is important to consider how to deal with these technologies in conservation programs.

There are various next-generation technologies that have become easier to utilize in recent years such as remote sensing with drone, real-time processing with small-sized computer and neural networks. Neural network is one of the machine learning methods inspired by human neurons, and shows high accuracy in various tasks.

In the present study, I focused on neural networks, especially on image recognition task using neural networks in next-generation technologies that will be adopted more in the future. I verified the effect on neural networks or on the combination of neural networks and remote sensing technology. And I discussed how neural networks can be applied to survey ecosystem through several researches. The results of this study show high potential of application of neural network to future conservation biology.

In Chapter 2, I constructed the system for automatically identifying seaweed on substrate rocks and assess seaweed coverage from photographic sea bottom image using semantic segmentation technology of the neural networks. Training of the neural networks yielded a system that can identify the position and outline of the seaweed on a rock substrate with high accuracy. In addition, this system shows a high degree of accuracy in detecting objects even on a fairly small rough photographic image. This study enables to accessing seaweed coverage nondestructively.

In Chapter 3, I constructed the system detecting *Anolis carolinensis*, which is one of the alien species invading Ogasawara Islands, from the image obtained by remote sensing technology. The animals were detected by object detection technology using neural networks. This study demonstrates that the combination of remote sensing and machine learning is useful for ecosystems managements.

In Chapter 4, the system constructed in Chapter 3 was expanded. In chapter 3, the neural networks detect objects using images as learning data. In Chapter 4, I conducted a training model using moving images as training data. By this operation, the model was able to utilize not only spatial information but also temporal information for detection of images.

Finally, I discuss the application of the image recognition technology of neural network to ecology and conservation biology. In the case of specific data, it is important to considering preprocessing of the data and the handling of the data. I also suggest that the range of application be improved by further other technological innovations in the future.