NEURAL NETWORK MODEL FOR IDENTIFYING THE COASTAL SAND AREA USING THE AERIAL PHOTOGRAPHS PICTURED BY UAV

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BACKGROUND

Small island states formed by atolls such as Marshall Islands, Kiribati and Tuvalu require useful and efficiency method of coastal monitoring for coastal management because of lack of human resources and budget. In atoll islands, the identification of shape of sandy beach and temporally accumulation area of sand has high importance in coastal management. In this study, neural network model to classify the aerial photographs pictured by UAV was established for identifying the sand area in the coastal zone of Fongafale island in Funafuti atoll, Tuvalu.

DATA COLLECTION IN FONGAFALE ISLAND

Photographs of coastal sediments especially sand, in Fongafale island were collected by digital camera. These photographs were used to make the data set for training and testing of the constructed neural network model. Additionally, aerial photographs pictured by UAV were collected to apply to the constructed neural network model.

DEVELOPING THE CONVOLUTION NEURAL NETWORK MODEL

In this study the convolution neural network was constructed to classify the aerial photographs. Constructed network model has three convolution and pooling layers and one full connection layer. The total number of training cases was 100, which differ in batch number and iteration of learning. Details of model parameter whose number of learning was set to 1,000 was indicated in Table 1. In the training of the model the sand photographs which was divided by 32 x 32 pixels were adopted. 10 cases training was indicated in Table 1, which differs in term of the batch size.

RESULTS OF TRAINING

Training accuracy in each leaning case is showed in Table 1, which indicates whether the photograph using in training was identified as the correct label. The results indicated that all training cases got better accuracy. In focusing the test accuracy in Table 1, the result indicates that the good test accuracy which are over 0.9 was got in all cases. The highest accuracy was provided by the case of the number of batch by 10. The batch number means that the learning volume in one iteration. Thus, the result that the highest accuracy got in the case of 10 batch number indicates that the once learning should be conducted by less volume .

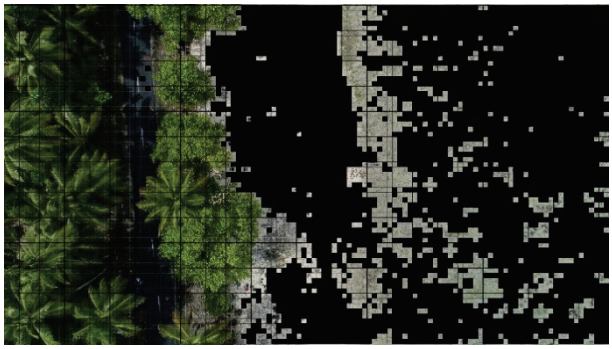

Figure 1 - Result of sand area identification. Detected area is showed in black colored area.

APPLICATION TO THE AERIAL PHOTOGRAPHS

An example of applicated result using the model trained with the batch number as 10 to the aerial photograph is indicated in Figure 1. In the figure the detected sand area are showed in black area. The result showed good agreement with the sand area which was identified by the eyesight detection from pictures, and the information from field investigation.

CONCLUSION

In this study the construction of convolution neural network model was conducted to adopt the sand area detection from aerial photograph. The results of training and test showed good accuracy and application to the aerial photograph provide good agreement with detected sand area from eyesight and field survey.

Table 1 - Parameters of constructed model, training accuracy and test accuracy

Picture size	Number of learning	Learning rate	Convlution layer					Pooling layer		Number of full connection layer	Batch number	Training accuracy	Test accuracy
			Size	Stride	Number of filter in Layer 1	Number of filter in Layer 2	Number of filter in Layer 3	Size	Stride				
32	1000	1.00E-06	3	1	32	64	128	2	2	1024	10	1.00	0.987
											20	1.00	0.982
											30	1.00	0.985
											40	1.00	0.984
											50	1.00	0.976
											60	1.00	0.980
											70	1.00	0.973
											80	1.00	0.975
											90	1.00	0.982
											100	1.00	0.974