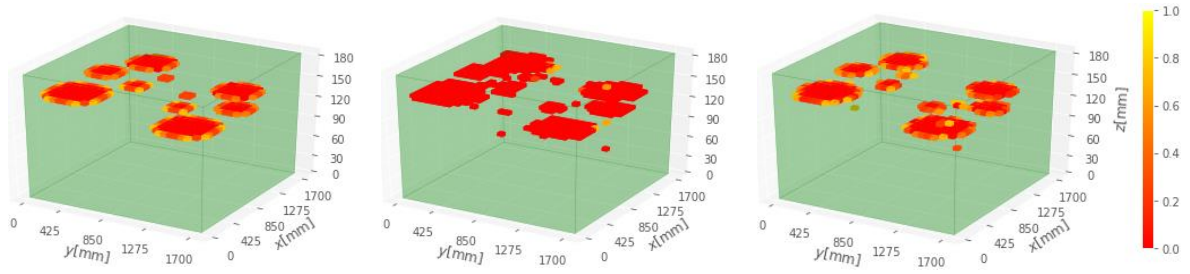
RESEARCH ON THREE-DIMENSIONAL CAVITY TOPOLOGY IDENTIFICATION IN CONCRETE STRUCTURES BASED ON MACHINE LEARNING USING HAMMERING RESPONSE DATA

M. Shimada [1*], T.Kurahashi[2], Y.Murakami[3], F.Ikeda[4] and I.Ihara[5]

[1, 2, 5]Nagaoka University of Technology,
1603-1, Kamitomioka, Nagaoka, Niigata 940-2188, Japan
[3, 4]Nagaoka National Institute of Technology, Nagaoka College,
Nishikatakai, Nagaoka, Niigata 940-8532, Japan
* s183044@stn.nagaokaut.ac.jp

The aging of concrete structures such as infrastructures is becoming a problem in Japan. To automate the maintenance of concrete structures, a system to identify topology of defects inside concrete structures is needed. In this research, we propose a method for identifying topology of cavities in concrete structures using machine learning. Acceleration time history data obtained from hammering tests are used as training data, and a convolutional neural network, which is generally utilized for image recognition, is applied to estimate the cavity topology. Since the convolutional neural network can retain relative positional relationships within the input information, it can input acceleration response data while maintaining information on the positional relationships of multiple sensors and is suitable for this task. For the hammering test data, pre-processing by dividing the acceleration response by the maximum impact force was performed to eliminate the effect of impact force, and it was confirmed that the pre-processing significantly improved the accuracy of cavity topology estimation.



(a) Actual cavity topology

(b) Identified results by CNN with original dataset

(c) Identified results by CNN with normalized dataset

Fig.1 Cavity topology (shape and location) in a concrete floor plate expressed by non-dimensional density distribution.

References

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