

Research Plan or Research Status Sheet

研究計画又は研究状況シート

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Theme(テーマ)	Structural health monitoring for reinforced concrete structures		

Title: Application of deep learning in predictions of the minimum number of sensors and the optimal locations of sensors for structural health monitoring (SHM)

[Introduction]

As repairing and enhancing existing reinforced concrete structures have taken place in the field of structural engineering, monitoring the performance and structural integrity of structures has been recognized as a high priority. Thus, reinforced concrete structures usually require as many sensors as possible to monitor their health condition to assure the safety of structures.

However, it is not easy to estimate:

1. how many arrays of connected sensors are required and where to install the sensors
2. how to track the locations of damages using optimal number of sensors
3. how to assess the condition of structures

In the research, deep learning will be introduced as a good candidate to analyze three issues above.

[Creating Datasets for deep learning model and validation model]

In the research, two types of datasets will be prepared:

1. Dataset from E-Defense test
2. Dataset from non-destructive and destructive test data from existing structures

Since E-Defense has gained popularity in recent years among researchers all over the world, sensor data from E-Defense test results will be used as a dataset for deep learning.

For the validation, non-destructive and destructive test data from existing structures will be used to ensure the model is generalizable.

Therefore, it can be found out that how well the model based on E-Defense estimate the most severe possible damages.

[Building a Model]

In the research, three deep learning models will be introduced:

1. Model for the optimal number of sensors and location of sensors
2. Model for tracking the locations of damages using supervised learning (Classification)
3. Model for assessing the condition of structures using unsupervised learning (Clustering)

Since E-Defense provides precise load combinations, accelerometer, displacement meter data, Convolution neural network (CNN) will used to figure out three models above.

[Solution]

As a result of the research, a new SHM process for existing structures will be proposed to reduce maintenance costs and increase the lifetime of structures.