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Multi-Sphere Deep SVDD for System Identification of Building Structure

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ABSTRACT

This study introduces a streamlined AI framework to detect structural defects in buildings using floor-level acceleration data, encompassing both normal and abnormal states (Fig. 1). The novel approach of this study uniquely identifies defect locations, including those absent in the training data, utilizing data from a 3-story shake table test. Multi-sphere deep SVDD, an unsupervised learning advanced from one-class deep SVDD (Ruff et al. 2018), was employed, allowing the detection of unseen defect locations. The model is trained with data consisting of both normal and abnormal cases, aiming not just to recognize known defects but also to infer unseen ones by comparing them to known types. Through this process, the model trained without specific defects and tested with them verifies its capability to identify novel anomalies. This study aims to enhance structural health monitoring by not only detecting concealed defects but also by estimating the nature of unlearned defects through their relation to known defects.

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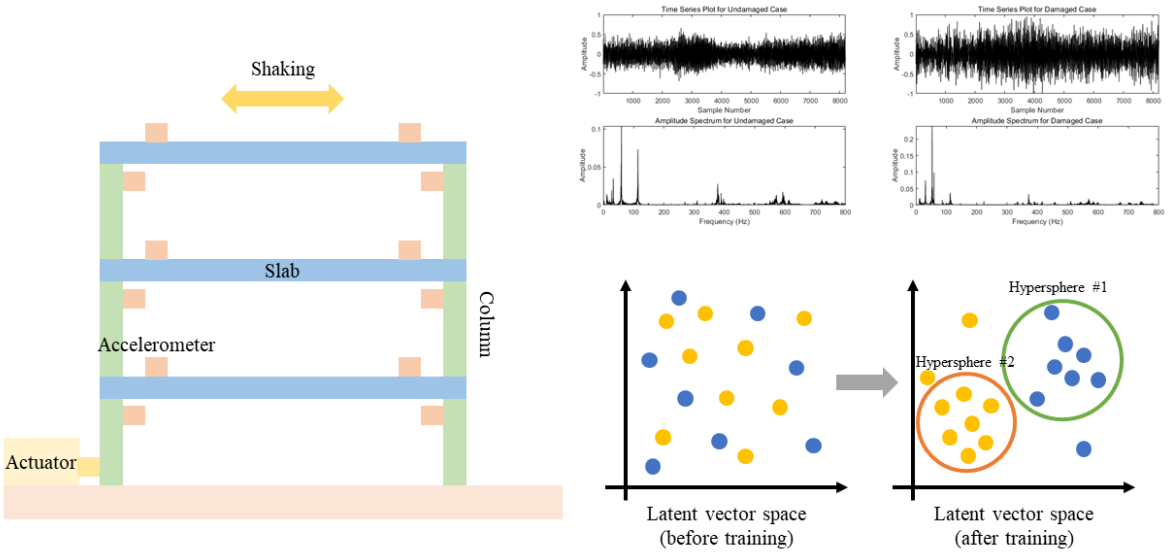

Fig. 1 Shake table test and support vector data description

REFERENCES

Ruff, L., Vandermeulen, R., Goernitz, N., Deecke, L., Siddiqui, S. A., Binder, A., Muller, E., and Kloft, M. (2018), "Deep one-class classification", *Proceedings of the 35th International Conference on Machine Learning*, Stockholm, Sweden.