

Data augmentation technique for construction engineering regression surrogate model

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In these days there is a trend to utilize simulation-based verification more frequently rather than verification through experiments using the product in the field of industrial product design. In this context, a development of an evaluation method instead of CAE is needed for more effective designing of industrial products. Machine learning methodology is one of the most anticipated way to accelerate evaluation process.

An application of a surrogate model in deep learning to engineering problems is still studied. In the our researches [1][2][3] the surrogate model using machine learning can predict physical phenomenon within 7% error compared with CAE prediction. The accuracy of the prediction is improved by augmentation technique, which is called as oversampling to avoid overfitting. The augmentation is conducted using data sets with low prediction accuracy.

The objective of this research is studying effective data augmentation for engineering regression problem. SMOTE is based on classification algorithm, however an engineering interpolation should be computed based on physical meanings and influential parameters.

In the machine learning the pedestrian kinematic response with a front part of a car is predicted and the predictor evaluates pedestrian's damage. The responses which are used as learning data are generated by 1D-CAE system. The prediction of the response can be achieved with less than 7% average error using all of data sets. Numbers of training data sets are varied in order to show the enough number and the predictor is evaluated for its accuracy. We'd like to discuss necessary of total number of training data sets and effectiveness of data augmentation.

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