Modeling Strength of High-Performance Concrete Using Genetic Operation Trees with Pruning Techniques

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Abstract

Regression analysis (RA) can establish an explicit formula to predict the strength of High-Performance Concrete (HPC); however, the accuracy of the formula is poor. Back-Propagation Networks (BPNs) can establish a highly accurate model to predict the strength of HPC, but cannot generate an explicit formula. Genetic Operation Trees (GOTs) can establish an explicit formula to predict the strength of HPC that achieves a level of accuracy in between the two aforementioned approaches. Although GOT can produce an explicit formula but the formula is often too complicated so that unable to explain the substantial meaning of the formula. This study developed a Backward Pruning Technique (BPT) to simplify the complexity of GOT formula by replacing each variable of the tip node of operation tree with the median of the variable in the training dataset belonging to the node, and then pruning the node with the most accurate test dataset. Such pruning reduces formula complexity while maintaining the accuracy. 404 experimental datasets were used to compare accuracy and complexity of three model building techniques, RA, BPN and GOT. Results show that the pruned GOT can generate simple and accurate formula for predicting the strength of HPC.

Keyword：back-propagation networks, genetic operation trees, high-performance concrete, backward pruning technique, median constant.