

Predicting the Compressive Strength of Geopolymer Concrete Using Machine Learning Algorithms: Impact of Chemical Composition and Curing Conditions

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Abstract : Geopolymer concrete is gaining recognition as a sustainable alternative to conventional Portland Cement concrete due to its environmentally friendly nature, which is a key goal for Smart City initiatives. It has demonstrated its potential as a reliable material for the design of structural elements. However, the production of Geopolymer concrete is hindered by batch-to-batch variations, which presents a significant challenge to the widespread adoption of Geopolymer concrete. To date, Machine learning has had a profound impact on various fields by enabling models to learn from large datasets and predict outputs accurately. This paper proposes an integration between the current drift to Artificial Intelligence and the composition of Geopolymer mixtures to predict their mechanical properties. This study employs Python software to develop machine learning model in specific Decision Trees. The research uses the percentage oxides and the chemical composition of the Alkali Solution along with the curing conditions as the input independent parameters, irrespective of the waste products used in the mixture yielding the compressive strength of the mix as the output parameter. The results showed 90 % agreement of the predicted values to the actual values having the ratio of the Sodium Silicate to the Sodium Hydroxide solution being the dominant parameter in the mixture.

Keywords : decision trees, geopolymer concrete, machine learning, smart cities, sustainability

Conference Title : ICCESE 2023 : International Conference on Civil, Environmental and Structural Engineering

Conference Location : Istanbul, Türkiye

Conference Dates : August 17-18, 2023