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# Estimating the effective fracture toughness of a variety of materials using several machine learning models

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## Abstract

Since conducting laboratory tests to obtain the fracture toughness of materials is time-consuming and costly, it is necessary to provide tools to estimate this property with high accuracy quickly and without the need for such a high cost. This study considered using machine learning (ML)-based models as a suitable option to address such problems. For this purpose, twelve ML-based models were presented using 1715 datasets generated from five experimental tests to estimate the adequate fracture toughness ( $K_{eff}$ ) of 44 different materials. The behavior of the ML models compared to the practice tests was investigated, and the correct and acceptable performance of each of them in estimating the  $K_{eff}$  of different materials was confirmed. Among the twelve ML-based models, extreme tree regressor (ETR) and Gaussian process regression (GPR) models provided the highest and lowest accuracies in estimating the  $K_{eff}$  of different materials, respectively. To further aid in the estimation of the  $K_{eff}$  of different materials for engineering challenges, a graphical user interface (GUI) for the ML-based models was developed.

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