A Study of Machine Learning Approaches to Predict Flow Curves at Different Temperatures and Strain-rates

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ABSTRACT

As an emerging of the data era, there has been many attempts to make use of them in many fields. It excels conventional approaches in terms of accuracy and prediction time. This work demonstrates an example in material mechanics. In material properties characterization, one should consider the changes in environment variables which couple each other and affect the mechanical response in experiments differently. Generally, it requires the expert's decision to analyze and decouple the effects.

This work applies three machine learning algorithms; Support Vector Machine (SVM), Artificial Neural Network (ANN), and Long-Short Term Memory (LSTM), to predict flow curves of a ferritic steel AISI 439 in isothermal condition. They are trained by experimental results at different temperatures and strain-rates in adiabatic condition. The predictions are compared with analytical solution of thermal-induced softening correction. In addition, the final validation is performed by comparing their predictions with an unseen experimental result.