

Prediction of Remaining Life of Industrial Cutting Tools with Deep Learning-Assisted Image Processing Techniques

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Abstract : This study is research on predicting the remaining life of industrial cutting tools used in the industrial production process with deep learning methods. When the life of cutting tools decreases, they cause destruction to the raw material they are processing. This study it is aimed to predict the remaining life of the cutting tool based on the damage caused by the cutting tools to the raw material. For this, hole photos were collected from the hole-drilling machine for 8 months. Photos were labeled in 5 classes according to hole quality. In this way, the problem was transformed into a classification problem. Using the prepared data set, a model was created with convolutional neural networks, which is a deep learning method. In addition, VGGNet and ResNet architectures, which have been successful in the literature, have been tested on the data set. A hybrid model using convolutional neural networks and support vector machines is also used for comparison. When all models are compared, it has been determined that the model in which convolutional neural networks are used gives successful results of a %74 accuracy rate. In the preliminary studies, the data set was arranged to include only the best and worst classes, and the study gave ~93% accuracy when the binary classification model was applied. The results of this study showed that the remaining life of the cutting tools could be predicted by deep learning methods based on the damage to the raw material. Experiments have proven that deep learning methods can be used as an alternative for cutting tool life estimation.

Keywords : classification, convolutional neural network, deep learning, remaining life of industrial cutting tools, ResNet, support vector machine, VggNet

Conference Title : ICCSIP 2023 : International Conference on Computer Science and Image Processing

Conference Location : Vancouver, Canada

Conference Dates : May 22-23, 2023