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A deep learning approach to the classification of 3D CAD models

用于三维CAD模型分类的深度学习的方法

Key words: CAD model classification, Design reuse, Machine learning, Neural network

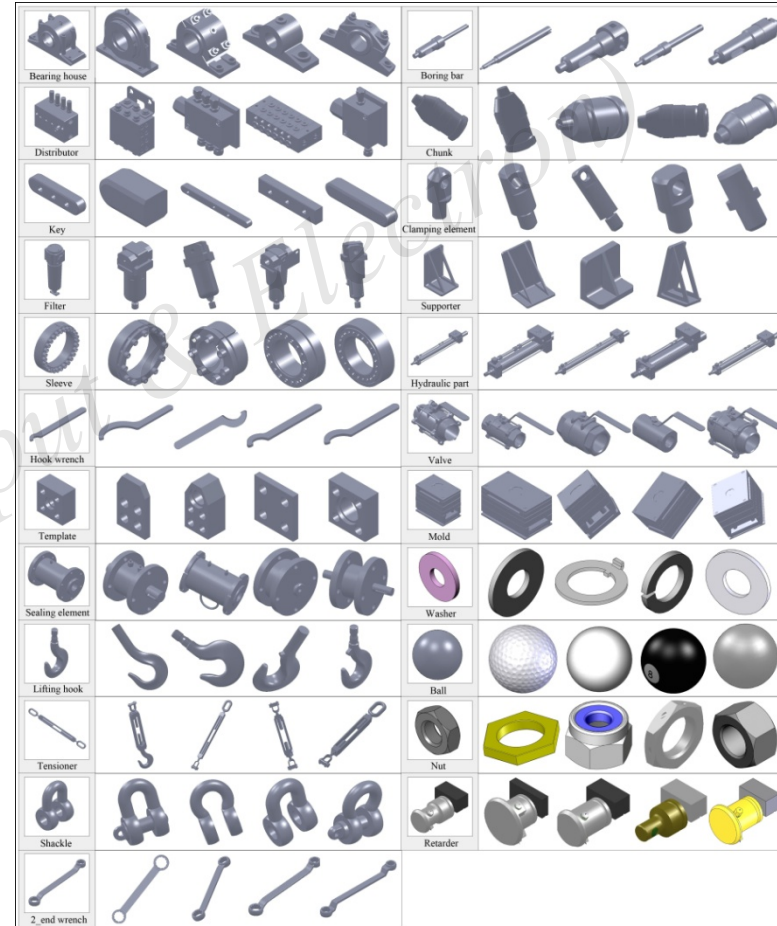
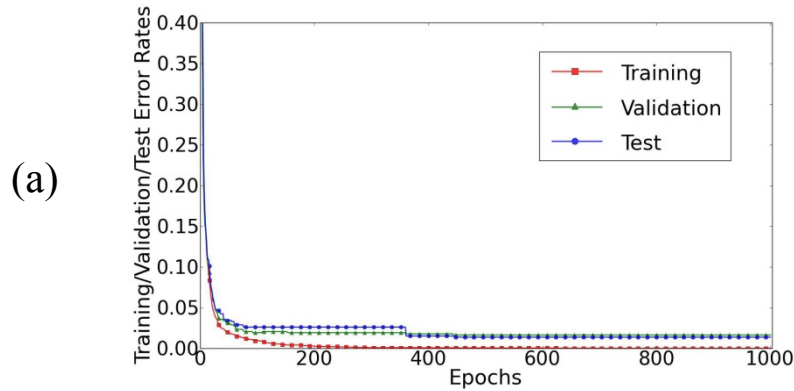
关键词： CAD模型分类； 设计重用； 机器学习； 神经网络

- CAD model classification plays a key role in effective management and organization of a large number of CAD models. Traditionally, 3D CAD model classification is primarily achieved by a time consuming and troublesome manual process, during which errors often come up. Therefore, an automatic and intelligent classification approach is of significance.
- In previous works, scholars usually tended to conquer the 3D model classification problem by exploiting machine learning techniques. However, constrained by the past development of machine learning techniques, these approaches are not mature enough to be used in industrial production.

➤ In this paper, we propose a deep learning approach to automatically classify 3D CAD models according to the mechanical part catalogue. The designed deep neural network classifier is based on the latest machine learning technique, deep learning, which is closer to the cognitive custom of engineers when they are conducting CAD model classification.

- (1) Analyze the representation ability of commonly used 3D shape descriptors and extract features from CAD models. Preprocess the input pattern and generate an input vector for the classifier.
- (2) Construct the deep neural network as the 3D CAD model classifier, including designing the topology of the deep architecture, allocating a certain number of neurons to every hidden layer, and so on.
- (3) Combine multiple practical strategies to train the 3D CAD model classifier and obtain the optimal solution.
- (4) Evaluate the acquired classifier and apply it to unknown 3D CAD model databases. If the classification accuracy is low, go back to the previous steps to retrain the classifier.

Example: (a) Curves of the error rates during the training process. Automatic classification results: (b) five categories which have non-zero error rates; (c) Twenty-three categories which have a zero error rate



The well trained classifier achieves relatively high classification accuracy on new 3D models.