Deep Learning for Lumber Identification

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ABSTRACT

Current lumber scanners used in industrial wood manufacturing plants such as rough mills and flooring plants are used to measure, evaluate the quality, and optimize processing of solid wood. Because various wood species differ significantly in their color, grain structure, natural characteristics, defects and density, for their optimal performance, the scanner sensors often need to be calibrated for each individual species. When production switches from one species to the next, the scanner settings have to be manually changed to new species. In this study, we attempt to automate species recognition based on image recognition so that the manufacturing equipment can automatically adapt to species being processed, or even be able to process batches of mixed species.

Recently, deep-learning techniques have demonstrated their usefulness in wood identification based on macroscopic cross-section images. Because such images are not easily obtained, this approach is not well suited for an industrial application. In this study, we used 4,736 transversal board face images of 11 hardwood species acquired by Microtec Goldeneye 300 Multi-Sensor Quality Scanner™. Most images were 70 x 500 pixels and were used to train the Convolution Neural Network (CNN)-ResNet. We achieved accuracy of 84% when identifying a single testing image of 224x224 pixels and 94% when applying majority voting without any parameter tuning. The average processing time was 0.07 seconds on GPU and 0.64 seconds on CPU. We expect that on-going work to increase training sample size and parameter fine-tuning will further increase the accuracy.