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GENERATION OF ARTIFICIAL TIMBER BOARDS WITH REALISTIC APPEARANCE FOR APPLICATION OF DEEP-LEARNING ALGORITHMS IN THE WOOD MANUFACTURING INDUSTRY

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Recent developments in Artificial Intelligence (AI) and advancements in the computational capacity has in the last few years led to the implementation of Machine Learning (ML) and Deep Learning (DL) algorithms in several disciplines in an unprecedented manner. However, although the wood industry has adopted digital image processing since several decades, the application of DL procedures in the wood industry is still in its very beginning [1]. One of the main reasons for this is that a considerable amount of data is required to train supervised DL algorithms [1 – 2] and these data must contain labelled input-output/target datasets. In practice, collecting and labelling a large enough training dataset to train DL algorithms in the wood industry is expensive and time-consuming and sometimes not feasible [1, 3]. Hence, the possibility of generating virtual/artificial training datasets for applications in DL algorithms would be valuable to help circumvent this bottleneck. In [2] artificial training datasets were used to train ML and DL algorithms to detect the pith location of timber boards, and in the present work, a stochastic model was used to generate virtual/artificial logs with realistic shapes and annual ring widths. From such generated logs, boards were virtually sawn out and based on the annual ring pattern visible on the surfaces of such boards, photorealistic board surface images were applied using a conditional generative adversarial network (cGAN). A one-dimensional convolutional neural network (1D CNN) was then trained, using thousands of generated virtual boards, and applied to detect pith location along real scanned boards. Thus, it is shown that DL algorithms can be developed and trained for use in the wood industry by using training datasets that are generated artificially.

For the purpose to determine pith location, training of DL algorithms can be done using virtual boards without knots. However, to extend the applicability of the stochastic log and board generator, e.g. to train DL algorithms for precise detection of knots and fibre orientation, the model to generate virtual logs and board model must include knots and related fibre distortion as well. Therefore, this is also included in the present research. In the slightly longer term, an aim is to use virtual timber boards including knots and fibre deviations around knots to train DL algorithms for precise detection of knots and fibre orientation in 3D for real scanned boards.

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