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Automatic detection and classification of surface defects in wood using neural network based image processing

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Defects in wood are features in wood which would reduce its strength, durability, quality, and economic value in the market. The objective of the present research is to use neural networks(NN) to classifythree common types of wood defects, namely, knots, cracks, and splits. This taskis accomplished by using digital image processing (DIP) techniques to pre-process data, feature extraction of wood defects, and create and train a NN to classify and predict the technique which gives the highest accuracy. Feature extraction is an important concept in DIP and in this study we addressed the issue of detecting defects in wood using texture extraction features based ongray-level co-occurrence matrix (GLCM), local binary patterns (LBP), and RGB colour space.The wood defect images were collected from timber mills at Welisara, Kiribathgoda, and Moratuwa. A sample of 75 images was taken from each individual defect, and a further 75 images of non-defect wood, making up a total of300 images. The collected images were preprocessed using median filtering and was fed into four types of learning algorithms, namely, support vector machine (SVM), pattern recognition networks (patternnet), bootstrap aggregating (bagging), and boosting. The patternnet was coded manually with a sigmoid hidden layer of 10 neurons. 70% of the data was given for training and 30% of the data was given for validation and testing. The other types of networks were created using classification app which used five-fold cross validation.The best classifier has been selected by comparing the precision values of the different classifiers used. This study has revealed that patternnet with GLCM is the best classifier with an accuracy of 88.5%, a precision of 88.45%,and giving the minimum error rate of 11.5% among all the classifiers.The validity of this research was demonstrated for certain types of wood only. Further research is in progress on more types of wood defects and also by considering the type of wood.

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