(103)

Pre-harvesting Sawn Timber Valuation System by using Neural Networks

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Abstract

Trees are a natural resource linked to human existence. Different tree species provide timber with varying properties such as strength, durability, resonance, color, scent, etc. Timber is transformed into a wide range of raw materials for use in construction, wood products, paper manufacturing, fuel source, etc. according to the qualities. Demand for timber resources in the world is increasing continuously due to the increasing population and industrialization. Currently, the main challenge faced by the timber industry is that there is no guarantee for a continuous supply of wood resources that need to feed existing industries and to encourage new investment in this industry. Therefore, forest resources should be managed and sustainably utilized timber resources. As one solution, the timber harvesting process can be utilized using new technologies in a more effective and convenient way for the humans and environment. In addition, timber planning will be the most important aspect of sustainable forest management. Therefore, the aim of this research is to develop a decision support system by Artificial Neural Network (ANN) technology with the back propagation learning algorithm to measure the worth of sawn timber, and loss conversion before the timber harvesting. This study focused on two types of trees named Teak (*Tectona grandis*) which is the most widely consumed timber and Jack (*Artocarpus heterophyllus*) which is a very strong and valuable timber in Sri Lanka. The data were collected from Ethgala depot in Gampola and Thalalla depot in Matara where sub-stations of the State Timber Corporation in Sri Lanka. There were 152 and 130 recorded data for Jack and Teak trees respectively. Randomly selected 80% of data from each of the types have been taken as the training data set. It has been used to select suitable parameters and the best network architecture by modifying the weights. The rest of the data has been considered as the testing data set which is not used to train the network and used to measure the accuracy of the model. The developed systems were able to evaluate the volume of sawn timber and loss conversion which is the difference between sawn timber volume and timber volume of the log, before the sawmill process giving the length, girth, and volume of the log as inputs. Constructed ANN model, that consists of 3-input nodes, 10-hidden nodes, and 2-output modes, with the back-propagation learning algorithm including learning rate parameter as 0.9 was used to obtain the results. There were different epochs corresponding to the Teak and Jack trees as 10,000 and 5,000 respectively because of the nature of the tree. This ANN system gave more accurate results and it will gain a comprehensive potential of timber harvesting and timber procurement and production planning.

Keywords: Neural network, Sawn timber, Valuation

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91