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A REVIEW: TO DEVELOP COMPUTATIONAL INTELLIGENCE TECHNIQUE BASED WOOD DEFECTS CLASSIFICATION SYSTEM

[1]Ms.Bhagyashri Umesh Vaidya,[2] Dr.V.L Agrawal,
[1]Student,[2]Associate Professor
[1,2] Electronic and Telecommunication of HVPM'S
College of Engineering and Technology, Amravati (India)

Abstract: Wood is that the thin, fibrous tissue found in the tops and roots of trees and other woody plants. It has been used for thousands of years for both fuels and as a construction material. Natural resources such as wood have become scarce and costly. Increasing consumption and reducing rejection (loss) is a major challenge in the timber industry. Wood defects are due to physical activity, genetics, or environmental influences during adolescence. These defects will reduce the amount of wood consumption. However, it is very difficult to determine if there is a defect exists, and the level of defects. Therefore, the successful detection of wood deformities is very important. A new wood defect detection method an efficient algorithm for wood defect identification using a neural classifier was proposed in this research for the detection of the wood defect. This chosen work purposes the tasks of extracting, classifying, and segmenting the five types of wood defect images using more efficient supervised learning approaches for more accurate and computationally efficient segmentation. The main aim of the purposed work to develop a computer-aided classification system of wood defectS.

Index Terms – **Wood defects, Neural network, MATLAB, Computational Intelligence.**

I. INTRODUCTION

Wood is made up of many cells that were produced by the living tissues in the tree. How the cells develop and are organized has profound effects on the properties of wood. The composition of the wood is also the basis for the division of wood into categories or species.

Natural resources such as wood have become scarce and costly. Increasing consumption and reducing rejection (loss) is a major challenge in the timber industry. The process of increasing the value of wood can be divided into three parts. Initially, the wood is transported to a sawmill and one has to decide whether the wood is more valuable as lumber, veneer, or chips. If it is for lumber, then the boards cut from it must be edged and trimmed. However this complete process requires the decision about trimming off effective parts and makes the board as valuable as possible. After that, someone has to inspect the board and give it a grade, based on the quality of the wood and the presence of defects. Finally, someone cuts the logs again to produce parts of the same size.

Defect develops in growing tree and timber. Some defects are a feature of living and cut trees (cracks, knots, and worms). Woodworking errors are produced during the procurement, transport, and mechanical working of the wood. The seriousness of the defect is determined by its type, size, and location, and the purpose of the wood used for it. Thus defects undesirable in some type of timber may be disregarded or even valued in others. For example, not acceptable for resonant wood, it is acceptable for commercial timber and is highly valued in plywood.

The main defects of wood include knots, Wormhole, Sound Knots, Rotten Knots, Curly grains, Roughness as shown below in figure

(a) (b) (c) (d) (e)

Figure1 :(a)Wormhole, (b)Sound Knots, (c)Rotten Knots, (d)Curly grains, (e)Roughness

A knot is part of a branch that is made of wood. Knots come from wood and disrupt their uniform structure. They twist the grain and ring of the year and weaken the wood when it is pulled with the grain and when bent. On the other hand, knots increase the strength of a wood that is pressed with a twist or cut from a distance.

Cracking is the separation of grains resulting from internal stress; they emerge or appear among the rings of the year. Cracks are caused by tree growth, low winter temperatures, and, even wood, degradation. They damage the integrity of the wood, thus weakening it.

Wormholes are passageways and an opening made in the wood by insects. . Insecticides usually cease after the bark has been removed and after the wood has dried or treated with antiseptics. Top worms do not affect the mechanical properties of wood. Deep holes disrupt the integrity of the wood and may reduce its strength. Wormholes usually promote the development of wood fungal stains and wood rot.

The classification of wood types is required in many industrial sectors as it can provide relevant information regarding the characteristics and characteristics of the final product (appearance, cost, mechanical properties, etc.). This analysis is typical in the furniture industries and wood panel production. Usually, the analysis is performed by human experts, it is not fast, and there is varying accuracy associated mainly with the driver's experience and care.

Usually, the analysis of the wood type in the wood industries is performed by human experts by visual inspection, but this procedure is not rapid and presents a non-uniform accuracy due to the operator's capabilities and tiredness. More expensive chemical tests are available, but they are slow and can be done only on small samples of production. It is well known that the type of wood can be estimated from the wood-extracted spectrum, but, unfortunately, translating the wood fluorescence mirror is not an easy task that can easily be found by a provider in a real industrial application. In fact, in the case of wood type identification, there are no distinct peaks at the tops of each wood range and small differences in the spectrum pattern are meaningful. As a result, the human identification of the wood type is not accurate and/or repeatable. In addition, more and more applications in the wood panel industry require the usage of enormous quantities of recycled wood as basic material. In this application case, this type of material should not be separated from a human-controlled system, and the use of a fast and accurate automatic identification system capable that will be able to control the continuous flow of samples from the plant line with the strength is required. To the best of our knowledge, no commercial systems are available in the market, and no studies on automatic wood classification systems are based on an efficient algorithm for wood defect identification using a neural classifier.

Therefore, the successful detection of wood deformities is very important. A new wood defect detection method an efficient algorithm for wood defect identification using a neural classifier was proposed in this research for the detection of the wood defect.

II. LITERATURE REVIEW

Shaoli Li, Dejian Li, And Weiqi Yuan," Wood Defect Classification Based on Two-Dimensional Histogram Constituted by LBP and Local Binary Differential Excitation Pattern,' IEEE 2019[1]

This paper explains a classification algorithm based on LBP and a local binary differential excitation pattern is presented for the classification of the crack and the linear mineral line on the surface of the birch veneer. The local binary differential excitation pattern (LB_DEP) is a texture description model proposed in this paper, which has been produced by a combination of LBP and Weber's Law and also describes the incidence relation between the image texture and the human visual perception. And the feature released by LB_DEP is expressed in a one-dimensional histogram. The author then develops a two-dimensional (2D) histogram made up of one-dimensional (1D) histogram for LBP and LB_DEP after standardization and integration. Finally, they used a 2D histogram to classify the defects with Euclidean distance classifier. They also established an automatic optical inspection system for the birch ice cream bar. They also conduct experiments with the images captured by the system. The results demonstrate that, compared with the state-of-the-art methods, their proposed algorithm can provide a better classification effect for the crack and the mineral line.

R. Qayyum, K. Kamal, T. Zafar, S. Mathavan," Wood Defects Classification Using GLCM Based Features And PSO Trained Neural Network,'2016 IEEE.[2]

This paper describes the novel's method of classifying wood knot defects for automatic testing. Their proposed technique utilizes gray level co-occurrence matrix-based features from 90 samples of different wood defects and a particle swarm optimization trained feed-forward neural network is used to classify the defects using GLCM based features. It assumes variability, adjustment, strength, homogeneity as parameters for inclusion in the neural feed-forward network to predict wood defects. PSO is used as a learning algorithm. The MSE for training data is found to be 0.3483 and 78.26% accuracy is achieved for testing data. Their proposed technique shows promising results to classify wood defects using a PSO-trained neural network.

Hongbo Mu, Mingming Zhang Dawei Qi, and Haiming Ni1.: The Application of RBF Neural Network in the Wood Defect Detection.: International Journal of Hybrid Information Technology Vol.8, No.2 (2015), pp.41-50. [3]

A new wood defect detection method was proposed in this paper by using RBF neural network. The new RBF defect detection method can be divided into five steps: First, they detect wood defects by using X-ray nondestructive testing technology. Second, they Deal with defective images by using digital image processing technology. Third, they analyze the information of different defects and extract the characteristic value of wood defects. Then, they constructed the RBF neural network model. Finally, the RBF neural network is trained with known samples and made up of unknown samples. The experimental results showed that the RBF neural network method was effectively detecting the two typical wood defects. This method provides an important theoretical basis to realize the wood defect automatic detection. After the experiment, the distinguishing crack and decadent accuracy rate Indicating that the RBF network has been designed and has a preliminary success.

Ricardus Anggi Pramunendar, Catur Supriyanto, Dwi Hermawan Novianto, Ignatius Ngesti Yuwono,Guruh Fajar Shidik, Pulung Nurtantio Andono.: A Classification Method of Coconut Wood Quality Based on Gray Level Co-Occurrence Matrices.: 978-1-4799-1208-7/13/$31.00 ©2013 IEEE.[4]

In this paper experimental work on coconut wood quality classification using self-tuning MLP classifier (AutoMLP) and Support Vector Machine (SVM). For the SVM classifier, they used the LibSVM library, available in Rapid Miner. The Gray-Level Co-occurrence Matrix (GLCM) is used to extract the texture features of coconut wood images. The Experiment result shows that AutoMLP gives the best performance compared to SVM. AutoMLP can be applied automatically to classify the quality of coconut wood with an accuracy rate of 78.82%. There is a further improvement, feature selection strategy needs to be added to wood quality automatically grading. They can select the worst feature that decreases the accuracy. So, a Feature selection strategy also can be used to speed up the computational time of the classifier.

Vincenzo Piuri and Fabio Scotti.: Design of an Automatic Wood Types Classification System by Using Fluorescence Spectra.: IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS—PART C: APPLICATIONS AND REVIEWS, VOL. 40, NO. 3, MAY 2010. [6]

This paper presents a methodology to effectively cope with the design of an automatic wood type's classification system based on the analysis of the fluorescence spectra suitable for real-time applications. This paper presents an experimental setup based on a laser source, a spectrometer, and a processing system, and then, it discusses a set of techniques suitable to extract features in the spectra and how to exploit the extracted feature to train an inductive classification system capable to properly classify the wood types. Obtained experimental results show that the proposed approach can achieve good accuracy in the classification and requires a limited computational power, hence allowing for the application in real-time industrial processes.

III.RESEARCH METHODOLOGY

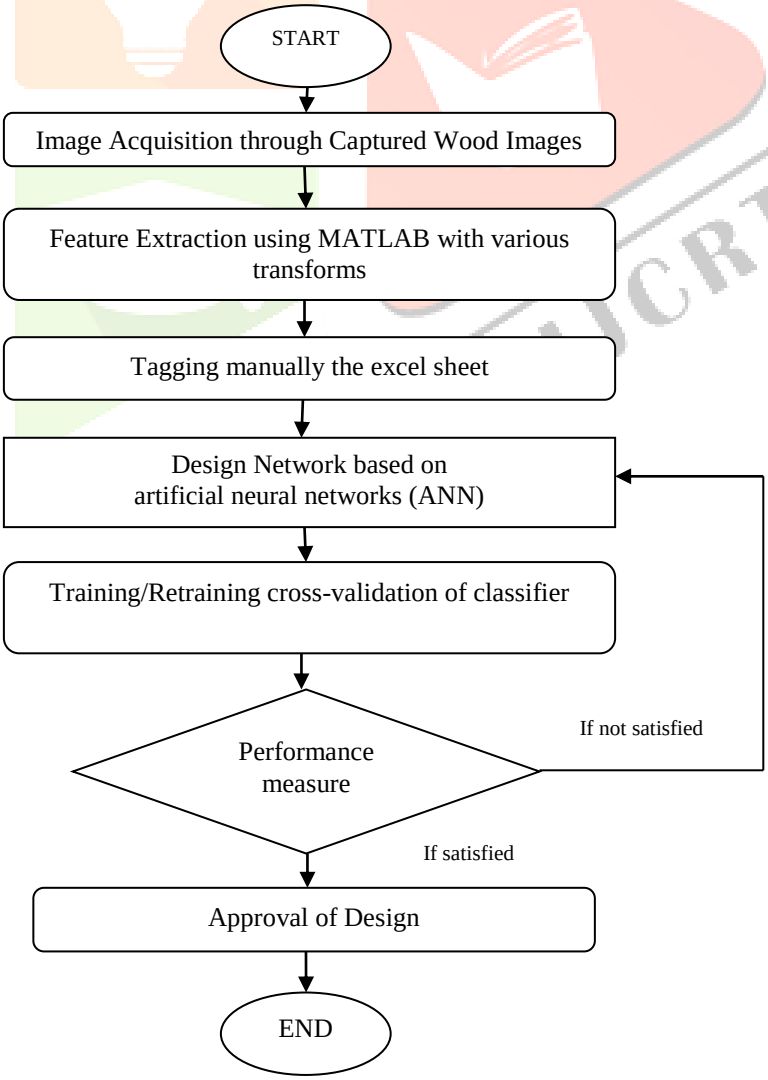

Figure 2: Flow chart

It is proposed to study the classification of five types of wood defect images Using Neural Network Approaches. Data acquisition for the proposed classifier designed for the Recognition of five types of wood defect images. Image data will be collected from different-different wood industries. The most important uncorrelated features, as well as coefficients from the images, will be extracted. To extract features, statistical techniques, the transformed domain will be used.

Computational Intelligence techniques include the following well-established techniques.
i) Statistics
ii) Learning Machines such as a neural network.
iii) Transformed domain techniques such as DCT, WHT, etc.

For the choice of a suitable classifier following configuration will be investigated.
i) Generalized Feed Forward Neural network.
ii) Modular Neural Network TOP-1 neural network.
iii) Support vector Machine Neural network

For each of the architectures, the following parameters are verified until the best performance is obtained.
i) Train-CV-Test data
ii) Variable split ratios
iii) Retraining a minimum of five times with different random initialization of the connection weights in every training run.
iv) Possibility of different learning algorithms such as Standard Back-Propagation, Conjugate gradient, Quick propagation, Delta Bar Delta, Momentum, etc.
v) Number of hidden layers
vi) Number of processing elements of neurons in each hidden layer.

After regions training & retraining of the classifier, it is cross-validated & tested based on the following performance matrix.
i) Mean Square Error
ii) Normalized Mean Square Error
iii) Classification accuracy
iv) Sensitivity
v) Specificity

To carry out the proposed research work, Platforms/Software like Matlab, Neuro solutions, Microsoft Excel is going to be used.

III.RESEARCH OBJECTIVES:

i) To maintain the correctness & accuracy in the Captured images even though the input images are contaminated by known or unknown noise.
ii) To increase the classification accuracy for the identification of the wood defect.

IV. CONCLUSION

This paper demonstrated how to use artificial neural networks (ANN) could be used to develop a computer-aided classification system of the wood defect. From the meticulous study, it is observed that there is a further scope to improve the accuracy by using different artificial intelligence approaches and we are trying to achieve a result more accurate and reliable.

V. ACKNOWLEDGMENT

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