UNIVERSITI TEKNOLOGI MARA

MULTILAYER PERCEPTRON NEURAL NETWORK CLASSIFICATION ON RRIM LATEX TIMBER CLONE (LTC) SERIES USING VISIBLE-NIR OPTICAL SENSING TECHNIQUE ON LATEX

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PhD

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Since 90 decades ago rubber breeding program has been initiated by Rubber Research Institute of Malaysia in producing the best clone that able to generate high latex yielding and good as timber which is known as RRIM LTC series. The current target by the government also highlighted the focus for maintaining the upstream sector which is in cultivation and breeding program, as stated in RMK12 and NKEA. Although RRIM had overcome the issue by introducing more than 200 clone's series but the hitches in identification these clones still prevailing due to lack of information in reference books and required skill from the expert person. As a parallel to this matter, a mechanism that can identify types of clones recommended for planting without assistance by the experienced worker needed crucially. Therefore, the motivation of this study is to develop a VIS-NIR prototype and an intelligent system for RRIM LTC identification. The latex samples came from five selected clones which consist of RRIM2000 and RRIM3000 series as suggested by verified clone inspectors from MRB based on their high latex yielding and good as timber. The developed sensor consists of three Visible LEDs and a NIR LED as sensing elements. The sensing element will transmit rays on the latex surface and a photodiode will receive the reflected rays from the surface. The measured output of this sensor is in Voltage which represents the reflectance index value. Then, the statistical method used to analyse to obtain particular inference analysis based on VIS-NIR optical properties for clones. The statistical analysis will provide initial findings on the behaviour of the populations based on numerical and graphical information. The second findings are via an automated system using ANN concluded that all clones can discriminate between each other with regards to the VIS-NIR optical properties with 79% accuracy and 91.6% of sensitivity. Meanwhile, the acquired performance from the best-optimized model has been inserted into the MATLAB GUI for validation purposes named Vision Interactive System. Overall, four clones show the accuracy of true prediction ranging from 73% up to 90% while only RRIM2002 able to achieve at least 60%. This infers the develop classifier system is effectively able to recognize the RRIM LTC series. Hence, it can be concluded that all LED voltages can discriminate between clones and these imply that the optical sensing is successfully in producing output voltage represented the reflectance index for VIS-NIR optical properties which can be used for discrimination between clones. The results presented here have proven that the optical properties are suitable in characterizing the clone types. Furthermore, this study may facilitate improvements in the upstream sector for rubber clone series inspection in the electrical engineering perspective.

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