DEVELOPMENT OF EMPTY OIL PALM FRUIT BUNCHES (EFB) SEGREGATION USING MACHINE LEARNING

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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This report is submitted in partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering with Honours

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DEDICATION

I would like to dedicate this project to my final year project supervisor and Co-supervisor who have been constantly giving support and dedication to all family members giving the dedication to complete this project.

ABSTRACT

This project represents the development of empty oil palm fruit bunches (EFB) segregation prototype using MATLAB for the different age group. Most of the manufactured industry does not utilize the production by using the EFB according to suitable age. This problem occurs because the products do not have the good system to be implemented to segregate the EFB according to their age specification such as to improve the parameters for the machine to be operated. This is very crucial in the industry because the different age of EFB for making commercializes purposes and generate additional income to the palm oil company. The approach of this control system starts with building the high percentage of identification for each bunches belongs to which age group. The neural network is using the MATLAB software to train the parameter given and it automatically adjusts to the network's weights and biases. The system starts with after the drying process of the bunches after the milling process, MATLAB based of Neural Network as the threshold data to identify each bunches group and determine the sample of EFB to segregate according to their age specification.

ABSTRAK

Projek ini menerangkan tentang pembangunan dalam prototaip mengasingkan tandan kosong kelapa sawit (TKK) dengan menggunakan aplikasi MATLAB untuk kelainan kumpulan usia. Kebanyakan industri tidak menggunakan sepenuhnya dalam menghasilkan seseuatu produk baru mengikut kemampuan kesesuaian usia TKK tersebut. Masalah timbul apabila dalam menghasilkan ssesuatu produk baru, satu system yang baik tidak dapat diimplikasi yang membolehkan mengasingkan kumpulan usia TKK tersebut dari segi penambahbaikan parameter untuk mesin berfungsi. Hal ini merupakan satu kepentingan kepada industri sebagai sedia maklum setiap lapisan umur mempunyai keistimewaan bagi menghasilkan sesuatu produk baru mengikut ciri-ciri yang spesifik yang mampu dikormesialkan serta memberikan variasi dampak positif kepada keuntungan industri tersebut. Kaedah pendekatan sistem kawalan ini bermula dengan menghasilkan kadar peratusan yang tinggi terhadap pengasingan TKK mengikut lapisan umur yang ditetapkan. Kaedah Jaringan Neural diimpikasikan dengan cara aplikasi MATLAB untuk mengajar sistem beroperasi dengan parameter yang ditetapakn justeru itu mampu justifikasi secara automatic berdasarkan jaringan berat dan bias. Sistem ini beroperasi dengan cara kaedah pengeringan TKK selepas diproses kemudian terus ke jaringan neural serta arahan yang betul sebagai sumber rujukan untuk menetukan usia TKK yang ditentukan. Tambahan pula, TKK akan desalurkan kepada penghantar yang betul dan di hantar kepada kilang yang besesuaian.

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The satisfaction that came after the completion of any task would be incomplete without mentioning the group of people who made it possible, the person who provide constant guidance, encouragement and support throughout this project. I consider it my privilege to express gratitude and respect to all those who involve direct and indirectly in the completion of this project.

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My deepest appreciation and to MPOB company supervisors, Dr. Kamarudin bin Hassan Head of Biomass technology, for thought and helped me to understand and learn various processes in palm oil fruit as well as understanding various processes within the plant.

Finally, I would like to convey my appreciation to all persons involved both directly and indirectly for their contribution and support to the success to complete this project. The thoughtfulness and kind help are much appreciated.

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LIST OF SYMBOLS AND ABBREVIATIONS

EFB	:	Empty Fruit Bunches
FFB	:	Full Fruit Bunches
NN	:	Neural Network
LVQ	:	Learning Vector Quantization
SOM	:	Self-Organizing Map
CNN	:	Convolutional Neural Network

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

This chapter introduces the overall project descriptions with its introduction of the project, problem statement, objectives, project scope, and project significance and to provide a sense of purpose and reasons to proceed with the project.

1.1 Introduction of the project

This project represents the development of empty oil palm fruit bunches (EFB) segregation prototype using MATLAB for the different age group. The current utilisation of the EFB is inefficient and low in productivity due to the age is hardly determined among the fruits after processes of an oil palm fruits extraction in the actual palm oil milling process.

The EFB is said to be the final product achieved where it is available in abundance after the milling process of FFB is successfully done where current

industry does not have the good parameters to reuse for making goods to the industry. This is because of lack of an economy system for handling and storage and less desirable quality of resulting products. By proposing the right method where can help on age classification it might help on the utilization of EFB to the industry.

Furthermore, if the objective achieved, thus the production of oil palm will increase because of the increase in quality were proportional to the production. This is very crucial in the industry because the different age of EFB for making commercialising purpose and generate additional income to the palm oil company.

The approach of this control system starts with building the high percentage of identification for each bunches belongs to which age group. The age of the bunch is determined by the length of bunch stalk devoid of fruit, EFB spikelet as shown in Figure1.1 (middle part of the fruit).

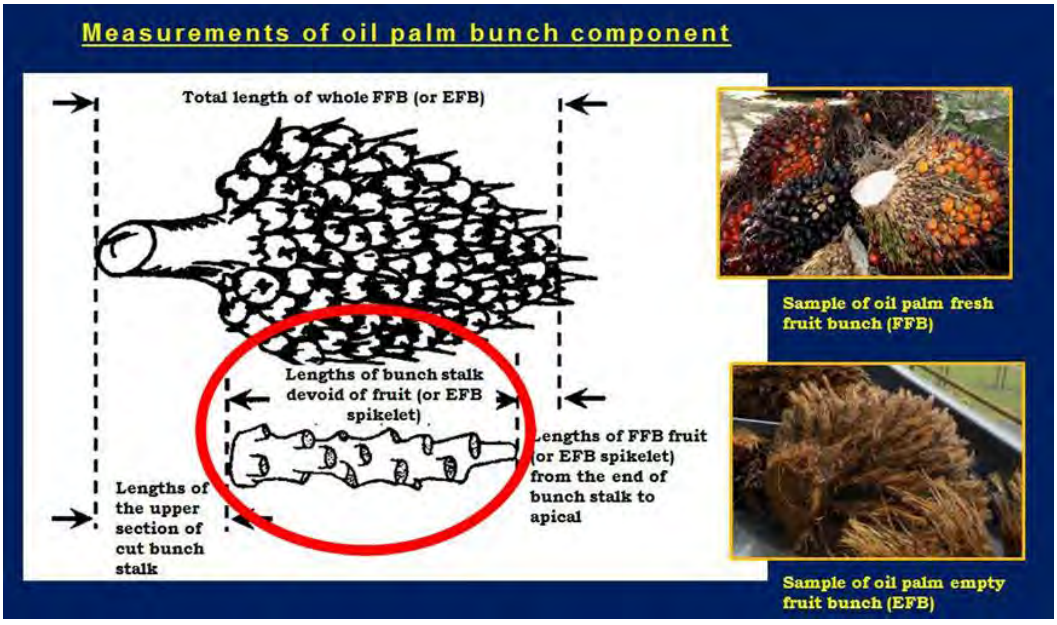

Figure 1.1 Measurements of oil palm bunch componenst. (The age of the bunch)

This project is to develop a prototype of oil palm fruit bunch segregation system, which divides the EFB according to similar fibre quality which considers as a similar age profile. This project represents the extension process after the milling process in the actual industry. Since it just to test the functionality of the prototype, the drying palm oil bunch cut into half will be presented as a sample.

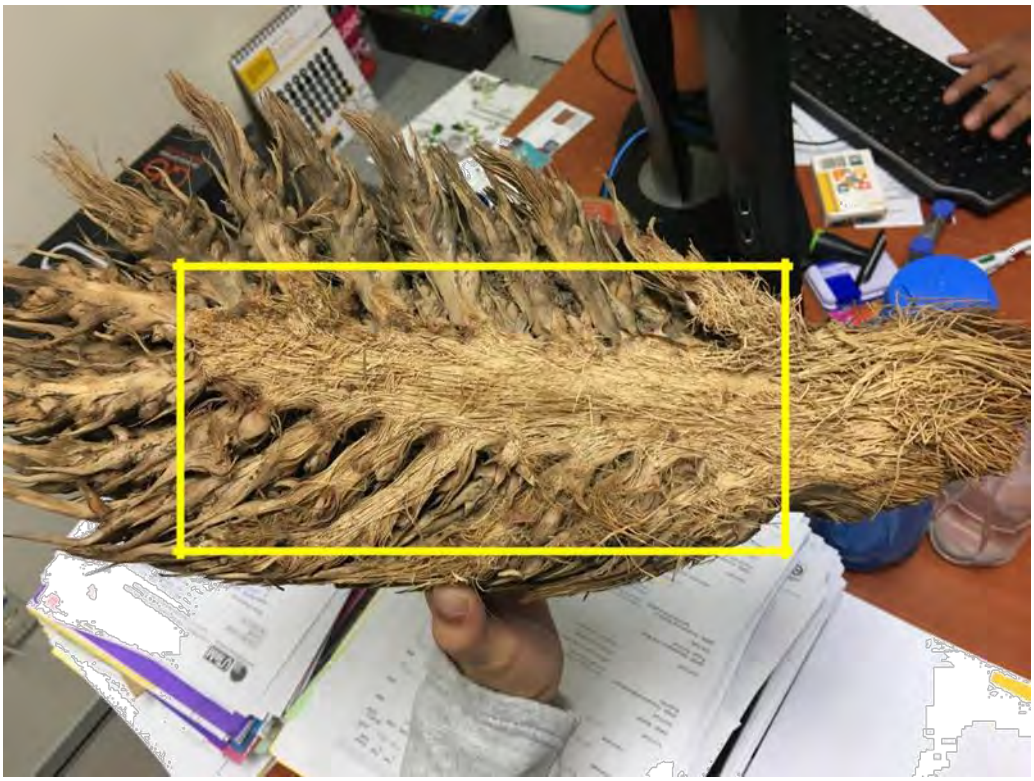

Figure 1.2: Drying palm oil bunch cut to half.

Camera act as an image sensor will firstly detect the image of EFB and differentiate to three types of measurement. The "*X*" value of the new sample (in the yellow rectangle box) will now be recognized as the new data in this report. The new data integrated with MATLAB based of Neural Network as the threshold data or database.

In order to create the database or to make it more understandable, the database now will be referred to the Neural Network training model as a brain. In fact, it would act as a self-learning of pattern classification. Measurements of palm oil bunch component data provided by MPOB researcher in a parameter which to identify the physical characteristics of oil palm fruit bunches and their relationships according to respective oil palm tree ages. The measurements given are measured manually using the measurement ruler.

Neural network method applied by using the MATLAB software, which used to train the parameter given and it automatically adjusts to the network's weights and biases. The result of palm oil bunch age will be the input for the segregation to occur. Lastly, the EFB will be sorting through the correct box conveyer according to their age specification and ship to the suitable industry.

Furthermore, if the objective achieved, thus the production of oil palm will increase because of the increase in quality were proportional to the production. This is very crucial in the industry because the different age of EFB for making commercialises purposes and generate additional income to the palm oil company. The approach of this control system starts with building the high percentage of identification for each bunches belongs to which age group.

This system prototype will be an emphasis on the industry where it will take over after the process of milling process where the segregation of EFB will occur according to their age specification.

1.2 Background

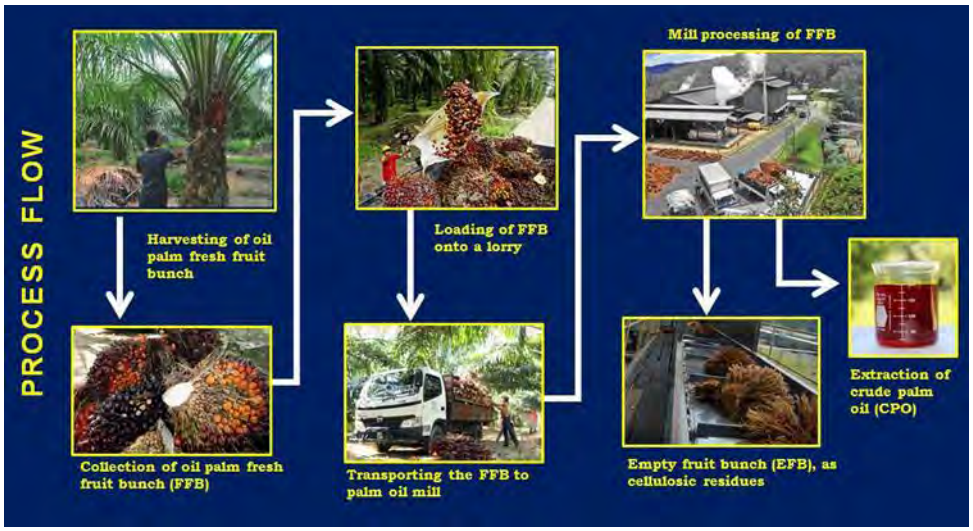

Figure 1.3: The palm oil process flow

Oil palm plantation in Malaysia is 5.74 million hectares, producing approximately 86.32 million tonnes of fresh fruit bunches (FFB) in 2016 [1]. The FFB was processed in the palm oil mill for oil extraction, leaving empty fruit bunches (EFB) and fruit (mesocarp) fibres as the main cellulosic residues. These cellulosic were currently being used in the agriculture sector for mulching the young palm tree (as nutrient on decomposition)[2]. According to barriers to economic use of Oil Palm Trunk (OPT) by plywood mills, the main issues will be on Logistics, handling the storage, inherent characteristics of OPT, processing and manufacturing processes, market competition & high cost of production[3].

In the report of MPOB 2015 it was found that the age classification of palm oil can be classified according to 4 age profiles which are immature from 3years old, young from 4 to 7 years old, prime from 8 to 17 years old and old from 18 to 25 years old. By using these data, it will help a new technology development to

determine the age of the fruit for better production in industry. These classifications can be shown below[1]:

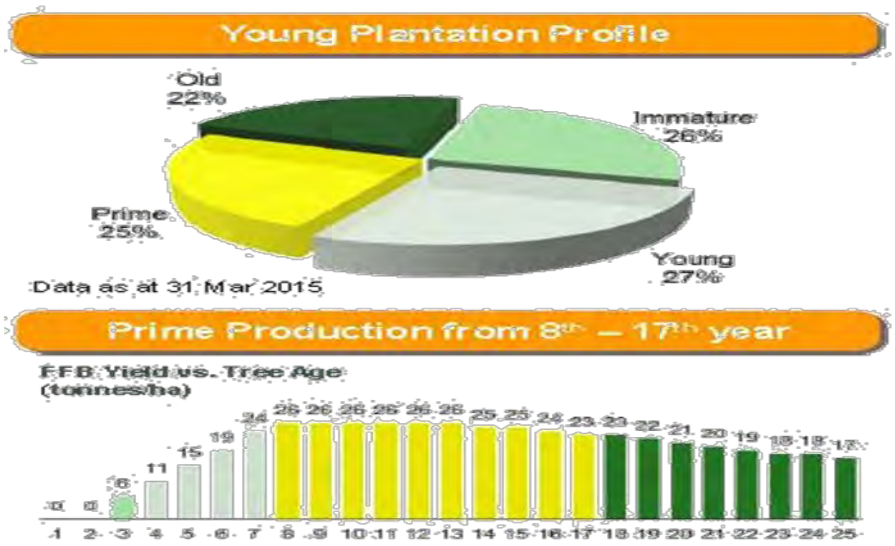

Figure 1.4: Age classification profile of the palm oil tree [1]

Because of the age is hardly determined among the fruits, thus EFB is not fully utilized by the industry. The EFB is said to be the final product achieved where it is available in abundance after the milling process of FFB is successfully done where most of the industry does not have the good parameters to reuse for making goods to the industry[4]. This is because of lack of the economy system for handling and storage and less desirable quality of resulting products[5].