# Jackfruit Maturity Classification Using Uniform Local Binary Pattern and Support Vector Machine

by

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## APPROVAL SHEET

This is to certify that we have supervised the preparation of and read the thesis proposal prepared by **Gene Lorenzo B. Bacalla** and **Emanuel Nasbien C. Corate** entitled **"Jackfruit Maturity Classification Using Uniform Local Binary Pattern and Support Vector Machine"** and that the said paper has been submitted for final examination by the Oral Examination Committee.

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As members of the Oral Examination Committee, we certify that we have examined this research proposal and hereby recommend that it be accepted as fulfillment of the thesis requirement for the degree in **Bachelor of Science in Computer Engineering**.

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This thesis research is hereby approved by and accepted by the School of EECE as fulfillment of the thesis requirement for the degree in **Bachelor of Science in Computer Engineering.**

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## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

# Chapter I

## INTRODUCTION

Jackfruit (*Artocarpus heterophyllus*) is a breadfruit crop which sees only 15% fulfilment of total annual demand in the Philippines [1]. Depending on the jackfruit's maturity state, it can be used as healthy alternative for meat or for making sweet goods. The Philippine National Standard (PNS) classifies the main varieties of Jackfruit with the local Sinaba and Tinumbaga [2], with modified variants such as EVIARC Sweet taking traction in terms of cultivation [3] and marketability in commercial farms due to its high sugar content [4].

Little research has been done for jackfruit maturity classification, particularly a classification model based on its physical features. This is despite of the spine density, pertaining to the number of spines on the jackfruit's rind, has been found to decrease as the jackfruit matures, while spine flatness, attributed to the lower height of spines, increases on ripe variants [5]. The previous approach for jackfruit maturity classification is based on its chemical traits. In the study of [6], disposable screen-printed strips are used to determine the maturity stage of the jackfruit based on its biochemical properties. According to the researchers, there are clear distinctions from each maturity stage of the jackfruit using Principal Component Analysis (PCA), with an 89% of total variance which distinguish the maturity groups, mainly immature, unripe, and ripe stages. A separate study that involved physical features of jackfruit is by [7], wherein Convolutional Neural Network (CNN) has been utilized to recognize four skin diseases through a trained model, yielding a 97.87% success rate with deep learning method. Additionally, Uniform Local Binary (ULBP) is a feature extractor utilized in recent studies involving textural pattern analysis. While commonly utilized on the

development of facial recognition algorithms [8], it has been utilized in agricultural field, including a lychee crop clusters detection system with a precision rate greater than 87%.

The limited research done for jackfruit maturity classification might be attributed to lack of publicly available dataset. While there are ample images on the internet, none of them are currently labeled, rendering them ineffective for the development of maturity classification system. Existing method for jackfruit maturity classification also requires destructive testing of the samples, stressing the development of non-destructive method with the emergence of computer vision and machine learning in agriculture.

The main objective of the study is to utilize ULBP operator and SVM to classify immature and mature jackfruit. The sub-objectives for the study would be: To implement the proposed hardware based on a Raspberry Pi 3 B+ platform with camera module and LCD Display for data gathering; to implement ULBP operator and SVM for training and testing procedure and; to evaluate the performance of the system in terms of accuracy.

The study will benefit the field of jackfruit cultivation by automating its maturity classification with a non-destructive method. The classification system can also aid jackfruit farmers by streamlining the process of confirming the fruit's maturity state. Therefore, the manual checking process will be eliminated while ensuring the good condition of the fruit as it reaches the consumer's market.

The scope of the study will only cover the mature and immature classification of EVIARC Sweet jackfruit species. The dataset will be obtained from regional farms on Luzon that cultivates EVIARC Sweet, using the proposed hardware device for data gathering. Additionally, the dataset will include varying sizes of whole EVIARC Sweet jackfruit, with a

total of 300 images to be obtained, wherein 150 for mature and 150 for immature. The system will be implemented based on Raspberry Pi Model 3 B+ as the main controller with camera module and LCD display.