

**DAMAGE DETECTION & CLASSIFICATION OF FRUITS USING
MACHINE LEARNING TECHNIQUE**

Submitted By

MD. EMRAN HASAN
ID: 152392002

SAIFUL ISLAM SAJON
ID: 152392317

A Thesis Report submitted in Partial Fulfillment of the Requirements for
the Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Sadia Jahan

Lecturer

Department of Computer Science and Engineering (CSE)
City University, Dhaka, Bangladesh



CITY UNIVERSITY
DHAKA, BANGLADESH
NOVEMBER 2019

CERTIFICATE

This Thesis titled “**Damage Detection & Classification of Fruits Using Machine Learning Technique**”, submitted by **Md. Emran Hasan** and **Saiful Islam Sajon** to the Department of Computer Science and Engineering, City University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation was held on November, 2019.

Approved By

Sadia Jahan

Lecturer

Department of Computer Science and Engineering (CSE)
City University, Dhaka, Bangladesh

DECLARATION

We hereby declare that, this research has been done by us under the supervision of **Sadia Jahan, Lecturer, Department of CSE** City University. We also declare that neither this project nor any part of this research has been submitted elsewhere for award of any degree or diploma.

Submitted by:

Md. Emran Hasan
ID: 152392002
Department of CSE
City University

Saiful Islam Sajon
ID: 152392317
Department of CSE
City University

Supervised by:

Sadia Jahan
Lecturer
Department of CSE
City University

ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty Allah for His divine blessing makes us possible to complete this research successfully.

We fell grateful to and wish our profound our indebtedness to **Sadia Jahan, Lecturer**, Department of CSE City University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of Machine Learning influenced us to carry out this project. Her endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this research.

We would like to express our heartiest gratitude to **Md. Safaet Hossain**, Associate Professor and Head, Department of CSE, for his kind help to finish our research and also to other faculty member and the staff of CSE department of City University.

We would like to thank our entire course mate in City University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

The food processing industry has been working with different kinds of fruits. Most of the industries who are classifying is a challenging task as it was costly and time-consuming. So, in this research work, we have proposed a method with a machine learning technique that will able to classify various kinds of fruits and detect damage automatically. We have used seven machine learning algorithms for validating our proposed method and k-mean and graph-cut segmentation technique to detect damage of fruits on fruit surface from fruit images.

Keywords: Fruit Classification, Damage Detection, Feature Extraction, Image Segmentation, K-means Clustering.

LIST OF ABBREVIATIONS

LR	Logistic Regression
LDA	Linear Discriminant Analysis
KNN	K-nearest neighbor
CART	Decision Tree Classifier
RF	Random Forest Classifier
NB	Gaussian Naive Bayes
SVM	Support Vector Machine
MLT	Machine Learning Technique

TABLE OF CONTENTS

CONTENTS	PAGE
Certificate	ii
Declaration	iii
Acknowledgements	iv
Abstract	v
List of Abbreviations	vi
Contents	vii-viii
List of Figures	ix
List of Table	x

CHAPTER

CHAPTER 1: INTRODUCTION

1.1 Motivation	02
1.2 Objective and Research Challenges	02-03
1.3 Contribution to Knowledge and Statement of Significance	03
1.4 Thesis Outline	03

CHAPTER 2: LITERATURE REVIEW

2.1 Damage Detection and Classification of fruit	05
2.1.1 Damage Detection	05-06
2.1.2 Fruit Classification	07-09

CHAPTER 3: PROPOSED METHOD	10-18
3.1 Fruit Identification and Damage Detection System	11
3.1.1 Image Preprocessing	12
3.1.2 Feature Extraction	12-14
3.1.3 Train Model	14-15
3.1.4 Identify Fruit	16
3.1.5 Damage detection	16
3.2 Proposed Method	17-18
CHAPTER 4: EXPERIMENTAL ANALYSIS	19-25
4.1 Data Collection	20
4.2 Dataset Information	20
4.3 Environmental Setup	21
4.4 Experimental Analysis	22-25
CHAPTER 5: DISCUSSION	26-28
5.1 Theoretical Implication for Classifying Fruit and Detecting Fruit Damage	27
5.2 Practical Implication for Classifying Fruit and Detecting Fruit Damage	28
CHAPTER 6: CONCLUSION	29-30
6.1 Future Work	30
REFERENCES	31-32

LIST OF FIGURES

FIGURES	PAGE NO
Figure 3.1: Fruit Identification and Damage Detection System	11
Figure 3.2: Proposed Method	17
Figure 4.4.1: Cross Validation Result	22
Figure 4.4.2: Fruit Identification Result	34
Figure 4.4.3: Damage Detection Using K-Means Algorithm	34
Figure 4.4.4: Damage Detection Using Graph-Cut	35
Figure 4.4.5: Damage Detection Using Graph-Cut(Histogram Plot)	35

LIST OF TABLES

TABLES	PAGE NO
Table 4.2.1: Dataset Information.	20
Table 4.3.1: Open Source Software/Project found from different Enterprise Repository online.	21