

UNIVERSITI TEKNOLOGI MARA

**Building Detection using Object-Based Image
Analysis (OBIA) and Machine Learning (ML)
Algorithms**

HANANI BINTI MOHD SHAHAR

Thesis submitted in fulfillment
Of the requirement for degree of
Bachelor of Surveying Science and Geomatics (Hons)

Faculty of Architecture, Planning and Surveying

January 2020

AUTHOR'S DECLARATION

I declare that the work in this thesis/dissertation 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.

Name of Student : Hanani Binti Mohd Shahar
Student I.D. No. : 2016725777
Programme : Bachelor of Surveying Science and
Geomatics (Honours) – AP220
Faculty : Architecture, Planning & Surveying
Thesis/Dissertation : Bulding Detection using Object-Based Image
Title : Analysis (OBIA) and Machine Learning (ML)
Algorithms

Signature of Student :
Date : January 2020

ABSTRACT

The information of building features especially in the urban area is very important to support urban management and development. Nevertheless, the automated and transferable detection of building features is still challenging because of variations of the spatial and spectral characteristics to support urban building classification using remote sensing techniques. Most previous studies utilized high-resolution images to discriminate buildings from other land use in the urban area and indeed it involves a high cost to achieve that purpose. Consequently, this study utilized a medium resolution remote sensing image, Sentinel-2 with 10-meter spatial resolution to classified the building in Selangor, Malaysia. In order to obtain a good classification accuracy, the suitable segmentation parameters (scale, shape and compactness) and features selection have been determined and Machine learning (ML) algorithms, namely Support Vector Machine (SVM) and Decision Tree (DT) classifiers have been applied to categorized five different classes which are water, forest, green area, building, and road. The result from these two classifiers was then have been compared and it is obviously showing that the SVM classifier is able to produce 20% better accuracy with 93% and kappa is 0.92. Thus, by enhancing the classification techniques in OBIA, building extraction accuracy using ML algorithms for medium resolution images can be improved and the expenses also can be reduced indirectly.

TABLE OF CONTENTS

ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS	iv
LIST OF FIGURES	vi
LIST OF TABLES	vii
CHAPTER 1	1
INTRODUCTION	1
1.1 Background of Study	1
1.2 Problem statement	2
1.3 Research Question	3
1.4 Aim of Study	3
1.5 Objective of Study	3
1.6 Scope of Study	4
1.7 Significant of Research	4
CHAPTER 2	5
LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Sentinel-2 satellite imagery	5
2.3 Land use land cover (LULC) using Sentinel-2	6
2.3 Building extraction using Sentinel-2	6
2.4 Object-based image analysis (OBIA)	7
2.4.1 Image segmentation	8
2.4.2 Feature selection	9
2.4.3 Image Classification	10
2.5 Machine Learning algorithms	11
2.5.1 Support Vector Machines (SVM) Classifier	11
2.5.2 Decision tree (DT) classifier	12
2.6 Data used in previous work	12
2.7 Related previous works on building extraction using OBIA method approaches	13
2.8 Summary	13
CHAPTER 3	14
METHODOLOGY	14
3.1 Introduction	14

3.2	Flow Chart	14
3.3	Study Area	15
3.4	Data and pre-processing	15
3.5	Optimal segmentation determination	16
3.6	Feature selection	17
3.7	Image classification	18
3.7.1	Building extraction	18
3.8	Accuracy assessment	18
CHAPTER 4		20
RESULT AND ANALYSIS		20
4.1	Introduction	20
4.2	Suitable segmentation parameters value for Sentinel-2B imagery	20
4.2.2	Segmentation parameters	21
4.3	Determination of feature selection	23
4.3.1	Accuracy assessment of features selection	25
4.4	Classification using SVM and DT	28
4.4.1	Accuracy assessment of classification	29
4.4.2	Validation of classified building	31
4.5	Building extraction	32
CHAPTER 5		33
CONCLUSION AND RECOMMENDATION		33
5.1	Introduction	33
5.2	Conclusion	33
5.3	Recommendation	34
REFERENCES		35