UNIVERSITI TEKNOLOGI MARA

EVALUATION OF MULTIBEAM ECHOSOUNDER BACKSCATTER FOR CLASSIFYING SEAFLOOR SEDIMENT USING UNSUPERVISED AND SUPERVISED TECHNIQUE AT NAVIGATIONAL CHANNEL

MUHAMMAD HAFIZUDDIN BIN MOHAMAD NAZRI

BACHELORS IN SURVEYING SCIENCE AND GEOMATICS (HONOURS) – AP220

JULY 2023

UNIVERSITI TEKNOLOGI MARA

EVALUATION OF MULTIBEAM ECHOSOUNDER BACKSCATTER FOR CLASSIFYING SEAFLOOR SEDIMENT USING UNSUPERVISED AND SUPERVISED TECHNIQUE AT NAVIGATIONAL CHANNEL

MUHAMMAD HAFIZUDDIN BIN MOHAMAD NAZRI

Thesis submitted in fulfillment
of the requirements for the degree of
Bachelor of Surveying Science and Geomatics (Honours)

Studies for Surveying Science & Geomatics,
College of Built Environment

July 2023

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.

Name of Student	:	Muhammad Hafizuddin Bin Mohmad Nazri
Student I.D. No.	:	2020611764
Programme	:	Bachelor of Surveying Science and Geomatics (Honours) - AP220
Faculty	:	College of Built Environment, CBE
Thesis	:	Evaluation of Multibeam Echosounder Backscatter for Classifying Seafloor Sediment Using Unsupervised and Supervised Technique at Navigational Channel
Signature of Student	:	……..
Date	:	31 July 2023

ABSTRACT

Capitalizing on the increased accessibility of bathymetry and backscatter data from multibeam echo sounders (MBES), this study explores the classification of seafloor sediments in a busy shipping channel. The dynamism of the seafloor, impacted by both natural and anthropogenic factors such as ship passage, demands robust techniques for accurate sediment classification. In this work, bathymetry and backscatter data obtained by the MBES Kongsberg EM2040 in 2021 were processed using software tools QPS Qimera, FMGT, and ArcGIS to derive both primary and secondary features. The former, limited in scope, were complemented by the latter that emerged from the integrated analysis of several data layers such as slope, BPI, rugosity, and backscatter properties. Principal Component Analysis (PCA) was employed to identify the most significant features for classification. For bathymetry derivatives, PCA generated 3 principal components where the combination explains a total of 95.08% for the total variance with Eastness (PCA1 – 35.67%), Northness (PCA2 – 68.69%), and Aspect (PCA3 – 95.08%). For backscatter derivatives, PCA generated 3 principal components where the combination explains a total of 99.66% of the variance with Mean (PCA1 – 92.88%), Second Moment (PCA2 – 98.11%), and Variance (PCA3 – 99.66%). Maximum Likelihood (ML) and ISO Cluster classification techniques were then applied, resulting in sediment maps with three distinct classes, similar to the results obtained from the Angular Range Analysis (ARA), employed as a proxy for ground truthing. The performance of the classification models was evaluated using Kappa and accuracy metrics, revealing that the ML Classification (Kappa: 0.087, Accuracy: 53.5%) outperformed the ISO Cluster Classification. Future work may consider ground truthing samples from the site to refine the classification further, employing techniques such as Random Forest. Finally, this research provides a new technique to classify the types of seabed sediment using backscatter which can determine and visualize using remote sensing and GIS technology.

TABLE OF CONTENT