FINAL THESIS BOOK
CAPSTONE DESIGN

Advanced Genomic Profiling and Classification of Breast Cancer Types: Leveraging Machine Learning Techniques for Precision Diagnostics

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TELECOMMUNICATIONS ENGINEERING BACHELOR'S DEGREE
FACULTY OF ELECTRICAL ENGINEERING
TELKOM UNIVERSITY BANDUNG
2025

APPROVAL PAGE

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Has been approved and ratified as part of the Capstone Design
Telecommunication Engineering Undergraduate Program
Faculty of Electrical Engineering
Telkom University
Bandung

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Bandung, 13 January 2025
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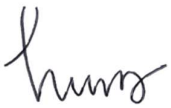

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ABSTRACT

One of the biggest causes of death for women is still breast cancer and survival rates are significantly decreased by delayed identification. This study aims to employ machine learning approaches to classify breast cancer subtypes by utilizing sophisticated genomic profiling. The web-based application that was built makes use of data from genomic profiling. It provides precise and effective diagnostics for categorizing breast cancer by combining Artificial Neural Networks (ANN) with 30 features and with 6 features.

Rigorous testing of the models demonstrated their effectiveness in classifying breast cancer subtypes. The ANN model with 30 features achieved a remarkable accuracy rate of 99%, while the ANN model with 6 features achieved 100%, showcasing its superior ability to capture targeted genomic patterns with fewer features. The fundamental difference between the two models lies in the number of features used for training, where the ANN with 30 features incorporates a broader feature set. In contrast, the ANN with 6 features streamlines the analysis for efficiency. Additionally, the application features are optimized for each model: the ANN with 30 features provides comprehensive diagnostics, while the ANN with 6 features ensures a more targeted and simplified analysis.

The system's performance was validated through black box testing, confirming its reliability and usability in real-time scenarios. The application ensures seamless interaction and robust data handling by integrating Streamlit for an intuitive interface and Supabase for backend data storage. This platform offers healthcare providers a cost-effective and scalable solution for genomic analysis, facilitating early detection and personalized treatment strategies for breast cancer patients.

In conclusion, this research emphasizes the transformative potential of combining machine learning techniques for genomic profiling and cancer diagnostics. By bridging advanced computational models with real-world healthcare needs, the application contributes to developing innovative, accessible, and accurate solutions for improving breast cancer patient outcomes.

Keywords: Genomic Profile, Breast Cancer, Machine Learning, Classification, Website

PREFACE

First, the author would like to express the gratitude to the Almighty God for all His abundant grace and gifts so that the author can complete the thesis entitled "Advanced Genomic Profiling and Classification of Breast Cancer Types: Leveraging Machine Learning Techniques for Precision Diagnostics" well and on time. This thesis is compiled as one of the requirements to obtain a bachelor's degree and complete studies in the Telecommunication Engineering Bachelor's Degree program at Telkom University, Bandung.

The selection of this topic is motivated by the need for a faster and more accurate way to detect breast cancer. The previous method of detection is rather lengthy overall and may induce anxiety and panic in patients. This website is expected to classify breast cancer types effectively, quicken initial results, and assist medical personnel in clinical decision-making using machine learning-based technology in a broader commercial environment. This reduces the diagnosis time and gives patients reassurance and certainty sooner.

This thesis has limitations, and the author's knowledge in this field is still developing. Therefore, the author expects constructive input and suggestions to improve this work. Finally, the author would like to express deepest gratitude to all parties who have supported during the preparation of this thesis and apologize for any errors or shortcomings. The author hopes this research will be helpful for readers, academics, and practitioners in machine learning, and social media analysis.

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ACKNOWLEDGMENT

With great humility and gratitude, the author wishes to express their heartfelt appreciation to all individuals and parties who have provided invaluable support, guidance, and encouragement throughout the completion of this thesis. Without their unwavering assistance, this research would not have been successfully completed.

First and foremost, the author would like to extend their deepest gratitude to:

1. Allah SWT, for His endless guidance, blessings, and strength that have illuminated the path and simplified every challenge throughout the research process.
2. Suryo Adhi Wibowo, S.T., M.T., Ph.D., as the first supervisor lecture, for his insightful guidance, expertise, and valuable advice that played a crucial role in the completion of this thesis.
3. Dr. Koredianto Usman, S.T., M.Sc., as the second supervisor lecture, for his comprehensive feedback and profound knowledge, which greatly enriched the depth and quality of this research.
4. Retno Hendriyanti, S.S., M.Pd., Ph.D., as the academic advisor, for her continued support, encouragement, and thoughtful advice throughout the course of this research.
5. Families, both immediate and extended, for their unwavering support, prayers, and motivation that served as a constant source of strength during the most challenging moments.
6. Classmates of TT45INT, for their camaraderie, collaboration, and shared journey that made this academic experience more fulfilling and memorable.
7. Friends in the Cyber Physical System Laboratory, for their shared knowledge, encouragement, and technical assistance that helped navigate through the complexities of this research.
8. Group mates of the DNA Group, for their teamwork, dedication, and collaborative spirit, which contributed significantly to the success of this project.
9. All staff of Telkom University, for their commitment, resources, and facilitation that created a conducive academic environment for learning and research.
10. All beloved individuals, for their continuous love, kindness, and support throughout the writing of this thesis, providing emotional strength and motivation to persevere until completion.

Lastly, the author is profoundly grateful to anyone whose names may not have been mentioned but whose contributions were equally meaningful. May all the assistance and support provided be repaid with blessings, and may this thesis serve as a valuable resource and inspire further research.

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LIST OF ABBREVIATIONS

ANN	: Artificial Neural Network
API	: Application Programming Interface
CPU	: Central Processing Unit
CSS	: Cascading Style Sheets
CSV	: Comma-Separated Values
FN	: False Negative
FP	: False Positive
GPU	: Graphics Processing Unit
HTML	: Hyper Text Markup Language
JSON	: Java Script Object Notation
JWT	: JSON Web Token
ML	: Machine Learning
PDF	: Portable Document Format
RAM	: Random Access Memory
ReLU	: Rectified Linear Unit
SQL	: Structured Query Language
SUS	: System Usability Scale
TN	: True Negative
TN	: True Negative
TP	: True Positive
TP	: True Positive
TPU	: Tensor Processing Unit
UI	: User Interface
URL	: Uniform Resource Locator
WHO	: World Health Organization