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
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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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I am prepared to accept the risks and repercussions that may be imposed on me in the future if this work is found to violate academic honesty or scientific ethics or if there is evidence of its originality.

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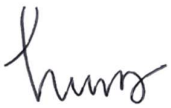

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ABSTRACT

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.

Bandung. 18 December 2024

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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